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QUARTERLY

OF THE

National Fire Protection Association

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10.

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60 BATTERYMARCH STREET, BOSTON, MASS.

Application Blank for Associate Membership

Associate Membership is open to any Society, Firm, Corporation or Individual interested in the protection of life and property against loss by fire. Persons in every walk of life are members.

National Fire Protection Association

INTERNATIONAL

Organized 1896

EXECUTIVE OFFICE: 60 BATTERYMARCH STREET, BOSTON, MASSACHUSETTS

All the valuable engineering and popular literature issued by the Association is sent, as issued, to every member.

We furnish free to members the Regulations issued by the National Board of Fire Underwriters, and the lists of devices and materials inspected by Underwriters' Laboratories, Inc.

The Association is the clearing house for all the authoritative information on Fire Protection and Prevention and members are privileged to submit to it their individual problems for solution.

PUBLICATIONS

Quarterly Magazine of the Association. A chronicle of the Association's activities, with valuable contributions of articles on fire prevention and protection and special hazards, and compilations of fire statistics on various classes of property.

News Letter. A special monthly bulletin of timely information on fire prevention and kindred subjects.

Proceedings of Annual Meeting. Containing stenographic report of transactions of the Association and the discussions incident to the adoption of its standards.

Special reports, bulletins, etc., issued frequently during the year.

Year-book and directory. Complete list of members with addresses.

Index to all subjects covered in the Printed Records.

NATIONAL FIRE PROTECTION ASSOCIATION,
60 Batterymarch Street, Boston, Mass.

Please enroll me (or us) as an associate member, and forward the publications to which members elected this month are entitled. I transmit herewith $10.00 as my annual membership dues, which includes a year's subscription to the "Quarterly" of the National Fire Protection Association.

Name.....

Business Connection.....

Street and Number.....

City and State.....

Membership year begins with date of election.

$10 per year dues is the total expense.

No initiation fee, no further assessments.

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

International.

Eight firemen cleaning up after a relatively minor blaze lost their lives when the old Collins Block in Syracuse, N. Y., collapsed on February 3, 1939. A deputy chief also died after the fire from overexertion and shock. The blaze from an improperly arranged flue weakened joists over the boiler so that they sheared off and pulled out from an unsupported bearing and division wall, which collapsed. This wall was 53 feet high and only eight inches in thickness. There was about two feet of snow on the roof. The fire department was apparently without previous knowledge of the weak condition of the building. Where there is no necessity for rescue work, fires in such dilapidated structures should be fought from the outside. Or better, such structures not worth protecting with sprinkler equipment should be removed.

The Quarterly

Vol. 32 April, 1939 No. 4

An Age Limit for Buildings. Modern building codes generally provide adequate safety for new structures, but the new buildings are only a small part of the total at any given time in a city's history. Municipal legislation seems to be based on the assumption that a building which complied with all legal requirements when erected may be continued in use in perpetuity. Provision is made, to be sure, to authorize local officials to order the repair or removal of old structures that menace the safety of the public, but as a practical matter public opinion supports the exercise of this authority only in the case of glaringly dilapidated structures, or those that have outlived their economic usefulness. There remain thousands of buildings which may be a menace to life in case of fire, but which still serve some useful purpose and which under present conditions it is impracticable to condemn. Such buildings are responsible for a considerable part of the annual fire toll. The building in Syracuse pictured on the preceding page, and the ninety-year-old Halifax Hotel described on another page of this QUARTERLY, are typical examples.

It is not reasonable to expect that even the best of modern buildings will necessarily be safe for occupancy seventy-five or a hundred years hence. All buildings deteriorate and become obsolete in time. Many buildings are designed and financed on the basis of a useful life of some definite period of years, running up to sixty years in the case of recent Federal housing projects, but generally much less than this. Why should not building permits be treated as licenses good for some specified period of years, depending upon the circumstances, and requiring after the expiration of this period that the building be removed, or revamped to comply with then-existing standards as a condition for renewal of the permit? Such a plan should in time automatically eliminate the more hazardous old buildings, without hardship to property owners who could make their plans accordingly long in advance. This plan could be applied to the older buildings now existing by requiring that when each present building reaches the age of say sixty or seventy years it must be removed or made fully safe in accordance with modern standards. Some modification might be made for buildings of historic interest, and for buildings over the age limit when the legislation was adopted, where enforcement without a few years' warning might work a hardship.

Liquefied Petroleum Gas Systems. The rapid growth in the installation of liquefied petroleum gas systems utilizing propane, butane and mixtures of these gases for both domestic and industrial purposes presents an interesting example of the type of service that the N.F.P.A. can render in guiding new developments along safe lines. These gases are combustible and when mixed with air in the proper proportions are explosive. Their use in thousands of isolated systems presents constant opportunity for fires or explosions as a result of improper installation or maintenance.

Anticipating this widespread development, the N.F.P.A. Committee on Gases, under the able chairmanship of Mr. H. E. Newell, Assistant Chief Engineer of the National Board of Fire Underwriters, has given constant attention to this hazard since its earliest development, and in close coöperation with the industry concerned has developed several separate sets of regulations to cover various phases of the hazard, including transportation of these gases in tank trucks and their use as automotive fuel, as well as the different types of fixed installations. Recognizing the need of fire marshals and other regulatory authorities for a code which would be in a form suitable for the legal regulation of the hazard, the committee prepared a Liquefied Petroleum Gas Code which has been widely utilized for its intended purpose. An informative article to explain the nature of these gases and the fundamental basis of the safeguards which have been specified was prepared by the committee and published in the QUARTERLY last April. Reprinted in pamphlet form, this has been widely circulated along with the other items.

There have been a few fires and explosions due to obvious and flagrant disregard of the precautions recommended by the committee. The fire and explosion experience, however, has been very moderate in view of the rapid and widespread installation of these systems. When installed by responsible concerns familiar with the hazards, we might expect the experience to be favorable. The danger, however, comes from entrance into this new business of all sorts of people having no previous experience and who have no conception of the potential hazards of the materials that they are handling. The N.F.P.A. fortunately, with the wholehearted coöperation of the leaders of the industry, is exerting a major influence in the proper education of the new people who are entering the business. Every mail brings inquiries on this subject to the N.F.P.A. Executive Office. One recent inquiry from a concern just starting the selling and servicing of liquefied petroleum gas systems came on a letterhead advertising the work of this company as "Mattress Renovating, Inner Spring Specialists, Tents, Awnings, Tarpaulins, Mirror Resilvering." With men entering this field without any experience even remotely related to gas installations, a major educational job supplemented by effective policing on the part of the regulatory authorities is needed.

A half dozen states where this development is most widespread have put the N.F.P.A. recommendations into effect as state law or as fire marshals' regulations having the force of law. In other states there are regulations based in part upon the N.F.P.A. recommendations, and municipal authorities who have to deal with this hazard are largely using the N.F.P.A. regulations as a basis of their requirements.

When gasoline was first introduced as an automobile fuel, the public had little understanding of its properties and consequently concentration on this hazard was necessary on the part of fire protection authorities. At present the hazard still remains, but the public generally has some understanding of the properties of gasoline and the fire and explosion experience is not severe in comparison with the enormous use of motor fuel. We may perhaps expect the use of liquefied petroleum gas to develop through a similar cycle. Thus far the experience has been very favorable for such a new hazard, owing to the work of the N.F.P.A. and the fine coöperation of our member organizations. In order to continue this good record, however, it will apparently require very careful attention on the part of all concerned for some years to come.

* * * * *

The Two Fairs. The New York World's Fair, and the Golden Gate International Exposition in San Francisco, like the Chicago Fair and other predecessors, are of particular interest to the fire protection fraternity. The fire protection of exposition structures presents unusual problems. Temporary structures do not justify the expense of fire-resistive construction and fire protection of the character provided for permanent buildings, but values are large, many lives might be endangered in case of fire, and even a temporary interruption of fair operation because of fire would be a serious blow. Compromises must therefore be made between costs and fire safety, and the way in which these compromises are worked out is of great interest to the fire protection fraternity.

In both New York and San Francisco first class fire department protection is provided; the apparatus can be used elsewhere afterwards. Water supplies and public fire alarm facilities for both fairs are reported as comparable with usual municipal protection. Extensive use of automatic fire alarms for the protection of individual buildings is made in both. However, the character of construction, large areas, combustible contents and general absence of automatic sprinklers would seem to present the possibility of a major loss if fire for any reason were not controlled in its incipient stage. The New York Fair has been selected for detailed treatment in this QUARTERLY because of certain features of particular technical interest to the fire protection fraternity, but the San Francisco Exposition presents a generally similar situation from the fire protection point of view.

Ciggyflipper, Dunk Your Cigarette.

The careless smoker, the cigarette smoker particularly, has been the bane of fire preventionists for years, and the menace shows no signs of abating. This problem has been attacked from every conceivable angle, but the cigarette fires continue. The N.F.P.A. office receives frequent calls from inventors of devices to eliminate cigarette fires, ranging from trick ash trays to fireproof cigarettes — all fine if people would use them.

Psychology, rather than mechanical equipment or law, seems to offer the best approach, and has been applied with some success in some cases. Recent Executive Office correspondence contains two interesting examples. Member Gilbert E. Stecher, on receipt of the N.F.P.A. cartoon-poster "The Prize Fool" wrote to call attention to the term "ciggyflipper," which he had coined with the thought that it might, in the fire field, serve the same sort of useful purpose as "joyride" in the field of automobile safety. From Grand Rapids comes another interesting idea, the "American 'Dunk' Your Cigarette Club." Founded by H. R. Bronkema, Chairman, Division of Fire Protection, Grand Rapids Safety Council, the club provides a life membership card and a dunking cup, all for ten cents. The member promises to keep the dunking cup, with a little water, near his ash tray.

AMERICAN "DUNK" YOUR CIGARETTE CLUB
Name Copyrighted

Division of Fire Prevention
GRAND RAPIDS SAFETY COUNCIL
GRAND RAPIDS UNIT

Board of Directors
S. T. Opfires, Chmn.
N. O. Losses
S. A. Velives
P. L. Aysafe

"LIFE MEMBERSHIP"

YOU, Mr._____ are now a life member of the American Dunk Your Cigarette Club.

YOU promise faithfully to "DUNK" your lighted cigarette in the water, in your DUNKING cup, which has been provided you with this membership. YOU promise to keep one or more Dunking Cups, in your home, and place of business, AND TO USE THEM.

YOU have done your bit, and are now Fire-conscious.

AMERICAN "DUNK" YOUR CIGARETTE CLUB
H. R. Bronkema, Founder

Meeting of Board of Directors.

Atlantic City, January 21, 1939.

Present.

Albert T. Bell, Chairman
S. D. McComb, President
D. J. Price, Vice-President
A. R. Small, Vice-President
Harold L. Miner, Past President
George W. Elliott, Past President
Franklin H. Wentworth, Managing Director

Eugene Arms
A. O. Dawson
Frank A. Epps
Hovey T. Freeman
Russell Grinnell
C. W. Johnson
W. E. Mallalieu
S. L. Nicholson
C. W. Pierce
H. Sidney Smith
Richard E. Vernor

There were also present Percy Bugbee, Assistant Managing Director, Robert S. Moulton, Technical Secretary, Horatio Bond, Chief Engineer, and H. E. Newell, Secretary, Flammable Liquids Committee.

Business Transacted.

1. The program for the 43rd annual meeting, Chicago, week of May 8, 1939, was discussed, and it was voted to adopt a registration fee of $2 for attending members and guests, excluding ladies.

2. Verbal reports were rendered by the Executive Office on Membership, Publications, Advertising in Publications, Field Service Activities and Volunteer Firemen's Section, and the Managing Director was requested to express to the Chairman of the Membership Committee the appreciation of the Board of his devoted and energetic service.

3. The Executive Office was directed to consider the preparation and publication of a second volume of the N.F.P.A. "National Fire Codes" covering protective rules and regulations.

4. A progress report on N.F.P.A. relations with the American Standards Association was submitted by the Conference Committee without action.

5. A resolution from the International Association of Electrical Inspectors relative to the relations between standards prepared by the Electrical Committee and those prepared by other N.F.P.A. committees was referred to the Executive Office for further consultation with the I.A.E.I., the Chairman of the Electrical Committee and others concerned, and report at a subsequent meeting of the Board.

6. The project for a membership certificate was referred to the Membership Committee for consideration and advices to the Executive Office with power.

7. A proposed Committee on Fire Protection Engineering Education was discussed, and referred to the Executive Office for further investigation in the light of the discussion, and report to a subsequent meeting of the Board.

8. The following addition to the Recommended Good Practice Requirements for Safeguarding Fire Hazards during Construction of Tunnels (Proceedings, 1936, p. 172), was adopted on recommendation of the Committee on Construction Operations. Change title of "18. Standpipes" to "18. Standpipes and Sprinklers," and add:

> "When tunnels are driven underneath water with the aid of compressed air and a shield, with the attendant wood platforms and timbering, that portion of the heading behind the shield should be protected by a system of manually operated sprinklers. The sprinkler heads should be of the open type, spaced not more than five feet on centers. They should be so arranged that the first line of heads will completely protect the shield. Additional rows should extend sufficiently far back from the shield to completely cover the entire working platforms, bracing and other combustible materials that are an accompaniment of the shield, but in no event should there be less than three rows transverse to the bore. A source of water supply and piping system sufficient to maintain a discharge of at least 25 gallons of water per minute at each head for a period of fifteen minutes, should be provided. The water supply for the sprinklers, controlled by an approved deluge valve, should be outside of the bulkhead at an accessible location. The sprinkler system should advance with the shield and should be installed with this point in view."

9. The report of the Committee on Technical Committee Procedure was accepted, and the following action was taken in accordance with the recommendations of the committee:

The 1938 edition of the Standard Specifications for Cotton Rubber Lined Fire Hose for Public and Private Fire Department Use, for which the N.F.P.A. as a member of the Fire Protection Group is joint sponsor with the American Society for Testing Materials under A.S.A. procedure, was adopted. It was voted to recommend to the Sectional Committee for this standard that they consider a rewording of paragraph 2 (*b*) of this standard in the form of a performance requirement, as distinguished from the present specification for a particular method of manufacture.

It was voted that the functions of the Committee on Blower Systems be subdivided between two committees, on Air Conditioning, and on Blower Systems, the personnel of these committees and the division of jurisdiction between them to be the subject of further consideration by the Committee on Technical Committee Procedure and report at the June meeting of the Board for confirmation.

At the request of the American Petroleum Institute, on motion of the Chairman of the Committee on Flammable Liquids, it was voted to discontinue the Recommended Good Practice for Marine Oil Terminals, edition of 1930, the principal subject matter thereof now being covered in the Suggested Ordinance for Petroleum Wharves, 1938.

On reconsideration of the request of the National Electrical Manufacturers Association for representation on the Committee on Trailers and Trailer Camps, it was voted to accord this representation.

It was voted to approve a proposal by the Committee on Gases to undertake the preparation of a standard on the storage of liquefied and compressed gases in warehouses, distribution centers, and other general storage, as distinguished from the storage at points of utilization, as covered in present standards.

The committee reported consideration of a resolution of the International Association of Electrical Inspectors (see Minute 5) and their inability to make any recommendation for

action thereon in the absence of sufficient information, believing that this matter should be further discussed with the I.A.E.I. before action is taken.

The committee recommended confirmation of the technical committee appointments listed in Minute 10.

Committee Appointments.

10. The following committee appointments were confirmed; also the various appointments referred with power to the President and the Committee on Technical Committee Procedure by action of the Board at the June meeting, and printed in the 1938 Year Book.

Automatic Sprinklers.

H. Clayton Kendall, replacing W. J. Carroll, National Automatic Sprinkler Assn.

William D. Lewis, replacing G. A. Russell, deceased, Board of Fire Underwriters of the Pacific.

Electrical.

W. J. Canada, replacing W. H. Greenlaw, International Municipal Signal Assn.

F. H. Moore, replacing Samuel R. Todd, International Association of Electrical Inspectors.

G. H. Reppert, replacing H. Chester Thompson, National Elevator Manufacturing Industry.*

Henry C. Sheve, replacing David Grimes, Radio Manufacturers Association.*

Farm Fire Protection.

Horace Davis, replacing Sherman V. Coultas, deceased, Fire Marshals Section N.F.P.A.

L. P. Keith, replacing H. J. Fox, National Lumber Manufacturers Association.

Fumigation Hazards.

C. E. Hibbard, replacing W. F. Dance, Jr., Virginia Insurance Rating Bureau.

Hazardous Chemicals and Explosives.

Marshall Rouse, replacing Palmer H. Cook, Board of Fire Unds. of the Pacific.

C. B. White, Chemical Fire Extinguisher Association, Inc.

Manufacturing Hazards.

C. H. Lindsay, Motor Fire Apparatus Manufacturers Association.

Protection of Records.

Arthur E. Kimberly, The National Archives.

Pyrotechnics.

Marvin Hall, Fire Marshal of Texas.

Safety to Life.

H. P. Vermilya, Federal Housing Administration, replacing Lawrence Veiller, National Housing Association.

Truck Transportation.

H. H. Kelley, Interstate Commerce Commission.

Visual Education.

Park L. Roberts, Executive Director, Junior Fire Fighters Clubs of America.

11. Chairman G. W. Elliott of the Special Committee appointed to consider the request of the Secretary-Treasurer and Managing Director for a change in his personal status, reported Mr. Wentworth's decision not to accept renomination for his present office for the next Association year, and Mr.

*Limited Memberships.

Elliott was requested to so notify the Nominating Committee. The Special Committee was continued for final report at the June Board meeting.

12. Communications from the Chairman of the Committee on Manufacturing Hazards, Benjamin Richards; the Chairman of the Committee on City Planning and Zoning, H. C. Klein; and E. V. King, State Superintendent of the West Virginia Inspection Bureau, were presented to the Board and referred to the Executive Office for reply.

Action by Letter Ballot.

In connection with the publication of the 1938 edition of the Regulations on First Aid Fire Appliances the Board of Directors, with the approval of the Chairman of the Committee on Field Practice, by letter ballot voted to retain the note under the title in the same form as decided by the Directors in January, 1936 (QUARTERLY, April, 1936, page 297, item 4).

Queen Hotel Fire, Halifax, Nova Scotia.

One of the most tragic hotel fires in recent years occurred at Halifax, Nova Scotia, on March 2, 1939, when an early morning fire, supposedly starting over the furnace room, swept the old Queen Hotel. As nearly as can be determined, twenty-eight persons lost their lives and nineteen others were seriously injured. Most of the victims were burned beyond recognition, and the exact death toll may never be known. In many respects the fire was a repetition of the Terminal Hotel disaster, which took thirty-five lives at Atlanta, Ga., last May. (See July, 1938, QUARTERLY.) The Queen Hotel consisted largely of old brick-joisted buildings. Unprotected elevator and stair shafts extended upward from the basement. There were no automatic sprinklers, no fire alarm system, no fire doors between sections, and the meager fire escapes were partly of wooden construction. Fire department rescue work was handicapped by the headway of the fire upon discovery, overhead wires in front of the building which hindered the placing of ladders, and absence of sufficient apparatus and manpower to handle a fire of this magnitude. The hotel and several adjoining buildings were completely destroyed. Other near-by property was damaged by fire, smoke and water.

Construction of Buildings.

The Queen Hotel consisted of several sections of varying height and construction which had been erected at different periods between 1849 and 1908.

NOTE: This report is based upon information and reports furnished by Major J. A. Rudland, Provincial Fire Marshal of Nova Scotia (Member N.F.P.A.); Mr. Edward J. Fahie, Secretary, Nova Scotia Board of Fire Underwriters (Member N.F.P.A.); and Mr. W. H. Connor, Engineer, Inspection Department, Associated Factory Mutual Fire Insurance Companies (Member N.F.P.A.).

Looking from the roof of the Canadian General Electric Co. building toward the reinforced concrete wing of the Queen Hotel. The fire entered this section through the unprotected wall openings, shown in this picture. Had fire doors been provided, several persons trapped in this wing might have escaped. At the lower left may be seen ruins of the kitchen section where several persons were taken from the roof by firemen.

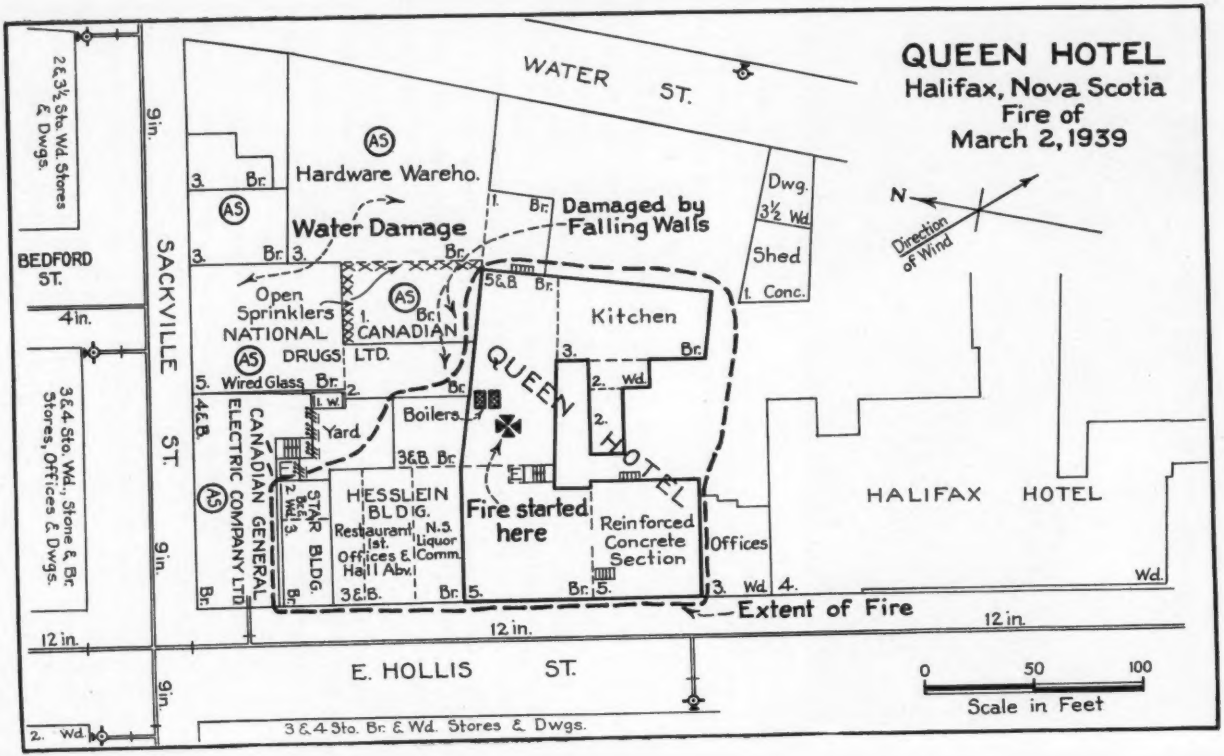
Numerous unprotected openings between the sections made the entire hotel one single fire area. The hotel had a frontage of about 112 feet. Part of the structure extended to a depth of 150 feet and included a kitchen ell in the rear. The hotel was located on a hillside, so that the first floor level at the front was three stories above the ground in the rear.

The main sections were of four to five-story brick-joisted construction. The kitchen wing was three stories in height. One five-story section of reinforced concrete construction adjoined the older sections at the south. There were no fire doors or other cut-offs between this wing and the brick-joisted sections.

The elevator and stairway were open with no protection against the upward spread of fire. It is also reported that a ventilating shaft located in the elevator shaft may have facilitated the rapid extension of the fire to upper floors.

The section of the building in which the fire started was ninety years old, the oldest part of the hotel. Interior partitions in this section were of wooden sheathing, thus lacking even the minimum degree of fire resistance afforded by ordinary plastered walls. Other parts of the hotel were said to be from sixty to seventy years old except for the reinforced concrete wing, which was erected in 1908.

Two three-story brick-joisted buildings to the north of the hotel were also destroyed by the fire. These were known as the Hesslein Building and the


QUEEN HOTEL
Halifax, Nova Scotia
Fire of
March 2, 1939
WATER ST.
Hardware Wareho.
Water Damage
Damaged by Falling Walls
Dwg. 3½ Wd.
Shed 1. Conc.
N
Direction of Wind
BEDFORD ST.
2 & 3½ Sto. Wd. Stores & Dwgs.
SACKVILLE ST.
9 in.
4 in.
Open Sprinklers
NATIONAL DRUGS LTD.
CANADIAN
Wired Glass
Yard
Boilers
Kitchen
QUEEN HOTEL
Fire started here
HESSLEIN BLDG.
Restaurant 1st.
Offices & Hall Abv.
N.S. Liquor Comm.
STAIR BLDG.
CANADIAN GENERAL ELECTRIC COMPANY LTD.
3 & 4 Sto. Wd., Stone & Br. Stores, Offices & Dwgs.
Reinforced Concrete Section
Offices
HALIFAX HOTEL
Extent of Fire
12 in.
E. HOLLIS ST.
0 50 100
Scale in Feet
3 & 4 Sto. Br. & Wd. Stores & Dwgs.

Star Building. The rear of the Hesslein Building adjoined the section of the hotel where the fire started. The fire entered this building by way of a window broken by a person escaping from the rear of the hotel.

Occupancy.

The Queen Hotel was an old establishment, once considered fashionable. In addition to transients it had a number of resident guests; during the winter many persons in Halifax move into hotels. The reinforced concrete section of the hotel building, in addition to the hotel occupancy, housed the store of a tenant concern dealing in typewriters.

The Hesslein Building contained a store of the Nova Scotia Liquor Commission and a café on the first floor, with offices and an assembly room above. The Star Building housed a clothing store, with a dwelling overhead.

Discovery of Fire and Alarm.

There was apparently no watchman service in the hotel the night of the fire. It is reported that instructions posted in the boiler room directed the night fireman to make hourly rounds of the building. A new fireman had started to work the night of the fire, relieving a former employee who had been discharged the evening before. The new man stated that he had not been instructed to make rounds of the building.

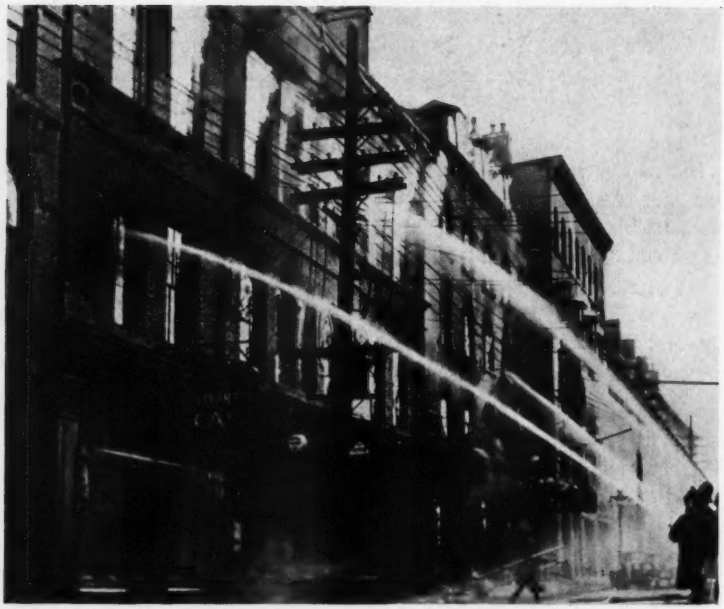
The fire was discovered by the night clerk and other employees. The clerk telephoned to the fire department and started to call the guests. There was no fire alarm equipment in the building. He, therefore, started to call the guests by individual telephone. Unfortunately, there was no provision for the simultaneous ringing of all telephone bells. The telephone equipment was of an old type which required that each room be plugged in and rung separately. Due to the headway of the fire when discovered, the clerk did not have time to make more than two connections before making his escape.

Loss of Life.

Seventy-eight registered guests and thirty employees were in the building when the fire started. Twenty-eight persons lost their lives or are known to be missing. Nineteen others were seriously injured. It is also said that resident guests were allowed to have visitors without the formality of having the visitors register. For this reason, the exact death toll may never be known.

There were no occupants in the rooms immediately over the boiler room and the fire apparently had burned unnoticed some time and gained great headway. Some of the guests of the hotel had no warning and doubtless some of them died in their sleep. Others aroused by shouts of "fire" found themselves trapped, with escape by halls and stairways already cut off by flames.

When firemen arrived occupants were jumping from the windows. According to witnesses, flames spread through all parts of the structure in about



International.

Front view of the fire which destroyed the Queen Hotel at Halifax, N. S., with a loss of twenty-eight lives. The burning Hesslein Building, which caught fire from the hotel, may be seen at the left. The overhead wires in front of the hotel seriously hampered rescue operations.

ten minutes. There were two outside balcony type fire escapes at the rear of the hotel, but flames coming from the windows soon made them impassable and the wooden flooring of the fire escapes ignited.

Upon arrival the fire department devoted all of its energies to saving persons calling for help from the windows at both sides of the building. Many occupants were carried down ladders by firemen. Several jumped into the fire department life net. Due to the shortage of manpower and ladder equipment in the department, rescue operations were considerably handicapped. The effective use of ladders was seriously obstructed by the maze of overhead wires along the street in front of the hotel. The wires particularly interfered with the maneuvering of the fire department's seventy-five foot aerial ladder needed to reach persons trapped on the upper floors.

Most of the loss of life occurred in the old rear section near where the fire started. Some of the occupants of the rear section made their way or jumped to the roof of the kitchen ell, where they were still forty feet above the ground and had to await rescue by firemen. One occupant of the rear section jumped to the low roof of a building north of the hotel and then escaped

Halifax Chronicle and Daily Star.

The rear of the Queen Hotel after the fire, showing the almost completely collapsed walls of the brick-joisted sections. At the left is the rear of the reinforced concrete wing. The unprotected outside balcony type fire escapes at the rear of the building were of little value because flames from the unprotected window openings ignited the wooden platforms with which the escapes were equipped.

through a rear window of the Hesslein building before that structure ignited. The older parts of the hotel began to collapse within half an hour of the start of the fire. The bodies of many of the victims were carried into the ruins.

It is believed that had the openings from the older sections into the reinforced concrete wing been protected by fire doors, the four or five persons lost in this section would have been saved. As it was, the fire spread into this section almost as quickly as to other parts of the hotel.

With halls and stairways cut off by flames many persons were trapped in their rooms. It is reported that ropes had not been provided at each window as required by law. Some of the occupants saved themselves by tying sheets together to form a life-line part of the way to the ground. Others jumped out to mattresses thrown from the windows.

It is said that the municipal factory inspector had been through the building on March 16, 1937, and made some safety recommendations. Apparently nothing had been done, however, and the inspector failed to follow up his first visit.

Fire Fighting Operations.

The first alarm was given over the telephone at 6:27 A.M. The fire department arrived within two minutes from its main station located about a block away. The first response consisted of two pumpers, an aerial ladder truck and a squad car. Two lines of hose were immediately laid at the front of the hotel. These were not charged at once because all of the men were needed to man the ladders. The balance of the department was promptly called, but the total fire department manpower and apparatus in the city were inadequate to simultaneously perform rescue and fire fighting operations. Actual fire fighting could not be started until rescue work was nearly completed. By that time the hotel and the Hesslein and Star Buildings were badly involved. At the inquest evidence was presented to show that all persons who appeared at windows were rescued by the fire department.

Under the circumstances the fire department should be commended for preventing a major conflagration. Had the flames reached the large frame Halifax Hotel at the south, it is impossible to say where the fire would have been stopped. Hose lines taken into a frame office building between the two hotels checked the fire at this point.

Effective work was also done in protecting the congested group of exposed buildings to the north of the fire. These included a four-story sprinklered building of the Canadian General Electric Co., Ltd., which was seriously exposed by the burning of the Hesslein and Star Buildings. Wired glass windows in metal frames prevented the fire from directly entering the General Electric building and no sprinklers operated. The windows themselves were badly damaged. The four-inch clay face-brick on the exposed tile wall was badly spalled and all of the asphalt weatherproofing was burned off the outer surface of the wall. This doubtless added to the density of the smoke entering the building. However, flames did ignite the wooden false roof and the roof of the elevator penthouse, but with the aid of hose streams and chemical extinguishers firemen prevented the fire from entering the concealed roof space of the General Electric building.

To the north of the rear section of the hotel, flames attacked and entered the brick-joisted sprinklered building of the National Canadian Drugs, Ltd.

View of some of the exposed property north of the Queen Hotel. At the left are the ruins of the small three-story Star Clothing Co. building. In the center may be seen the wired glass windows and the spalled brick facing of the building of the Canadian General Electric Co., Ltd. Boarded up at the right are the rear windows of the National Canadian Drugs, Ltd. Open outside sprinklers provided to protect these windows were not turned on and fire entered the building. Inside automatic sprinklers controlled the fire, but considerable smoke and water damage resulted.

Outside open sprinklers protecting the rear windows of this building were overlooked and were not turned on. The fire burned out the windows and opened sprinklers inside this building. Although the pressure tanks were eventually drained, the sprinklers continued to operate at city pressure and prevented the spread of the fire inside. A large water loss to the stock of chemicals and drugs resulted. The lower rear section of this building and that of an adjoining building occupied by a wholesale hardware concern were damaged by falling walls of the burning buildings. The hardware concern also suffered some water damage when water seeped into the basement where some electrical stock was stored.

There were two roof fires on buildings across the street from the rear of the hotel which were caused by flying brands. Several other structures suffered smoke and water damage. In all, the fire department used fifteen hose streams supplied by pumpers and hydrant pressure to protect the various exposures.

Origin of the Fire.

The exact cause of the fire may never be known, but it apparently originated over the furnace room, which was located in the basement of the oldest part of the hotel. Witnesses at the inquest indicated that coal gas fumes had been noticeable most of the winter. The two boilers were provided with automatic stokers. A witness stated that when the boilers were once cleaned with

the stokers in operation, smoke and sparks escaped and flew around the ceiling, due to the insufficient draft.

Ten feet above where the flue entered the chimney there was an old chimney opening behind the wood sheathing. If the opening had ever been protected with metal, the metal had disappeared. It is possible that heat and sparks escaped through the opening and ignited the sheathing.

Loss.

The total loss from the fire is believed to have been close to $200,000. Much of this damage consisted of smoke and water damage to exposed properties. While the Queen Hotel had once been valued at $210,000 it is said that the latest owner purchased it for only $17,500. The total insurance coverage on both the hotel and its contents was said to be only $33,000. The tenant typewriter agency in the hotel was insured for $18,000.

The Hesslein Building was a total loss and was said to have been insured for $30,000. The Nova Scotia Liquor Commission loss in this building was estimated at about $25,000. However, a brick vault in the liquor store preserved its contents which included about $1700 in cash. The loss to the Café in the Hesslein Building was about $4000.

Damage to the Star Clothing Company, the Canadian General Electric Co., Ltd., the National Canadian Drugs, Ltd., the hardware concern and other properties would bring the total loss to at least $200,000.

Conclusions.

Fire protection experts learned little that was new from this fire tragedy. The result was what might be expected from a fire in an old quick-burning hotel without any provisions for life safety. With no form of alarm service, no means of automatic fire protection such as automatic sprinklers, and with no protection for horizontal and vertical openings it is only remarkable that the disaster had not occurred before.

The fire also shows that a hotel night clerk cannot be considered as substitute for an automatic alarm service because he may not become aware of the fire in time to notify the guests. Also, except possibly in the largest cities, few fire departments have the equipment or manpower to save all of the occupants who may be trapped in a large hotel fire. It is impracticable to provide adequate public protection for large firetrap buildings such as this hotel; the owners of such properties should be required to so protect them that the hazard is reduced to a degree commensurate with reasonable public protection.

Also, the failure to turn on the outside water curtain on the National Canadian Drugs, Ltd., building indicates the limitations of such equipment when dependent upon unsupervised manual operation.

The New York World's Fair.

By William B. White (Member N.F.P.A.),
New York Board of Fire Underwriters.

The New York World's Fair, which is scheduled to open April 30, 1939, commemorates the 150th anniversary of George Washington's inauguration as President of the United States. The exposition occupies over 1216 acres of land situated on Flushing Meadows, which forms a part of the Borough of Queens, New York City. The site was originally a swamp, which necessitated excavating, filling and grading on a scale of considerable magnitude before it was suitable for use as a fair ground. It is proposed to use this reclaimed area as a public park after the Fair has closed. The Horace Harding World's Fair Boulevard passes through the grounds, dividing the land into two sections. To the north of this traffic artery are concentrated the main exhibition buildings, which cover an area of about 370 acres. South of the Boulevard is located the amusement section.

The question of the policy governing the fire protection of the Fair was referred to the Insurance Committee of the World's Fair Corporation, which is composed of prominent local insurance men. This Committee, in turn, appointed an Advisory Committee made up of fire protection engineers to act as counsel. The Advisory Committee in its early contact with the officials of the Fair stressed particularly the importance of providing fire breaks designed to subdivide the fire area, so as to avoid the possibility of a conflagration and at the same time afford havens to which visitors could go in case of an emergency, either from fire or panic. The Committee also recommended the establishment of a building code of sufficient elasticity to be acceptable to prospective exhibitors and at the same time to provide a reasonable measure of protection against fire, with full consideration for the temporary and generally combustible character of most of the structures. In general the officials of the Fair were urged to follow established principles of fire prevention and protection.

Building Code and Inspections.

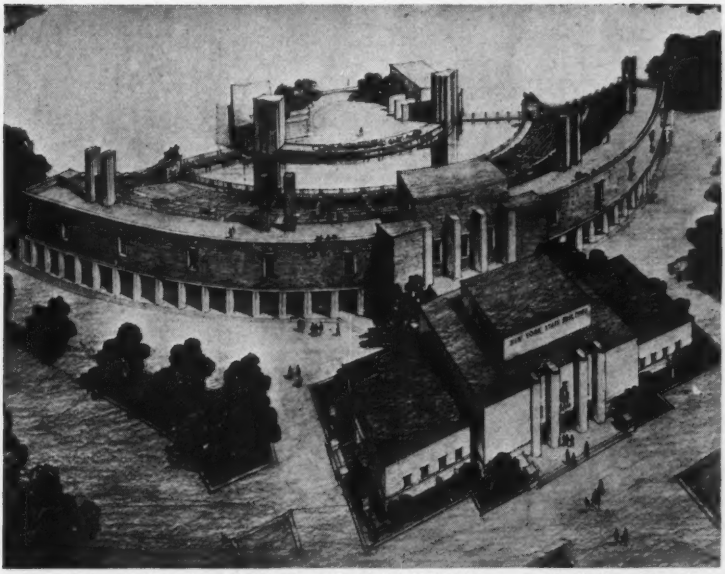
A building code was prepared for the exposition and was adopted by the Board of Estimate of the City of New York nearly three years prior to the date set for the opening of the Fair. Enforcement of this code is supervised by the Insurance Director, who works closely with the Advisory Committee. The electrical and fire alarm inspections are carried on during the construction period by the Electrical Bureau of the New York Board of Fire Underwriters, while an inspector of the New York Fire Insurance Rating Organization

View of the 70-foot façade of the Hall of Communications. Occupying over an acre of land, this building will contain a restaurant seating 500 persons in addition to communications exhibits.

examines other details of all properties. It is reported that a high standard of electrical installation is being obtained for the temporary nature of the exposition and steps are now in progress to require that fabrics used for decorating purposes shall be flameproofed and maintained flameproof to the satisfaction of the Fair officials.

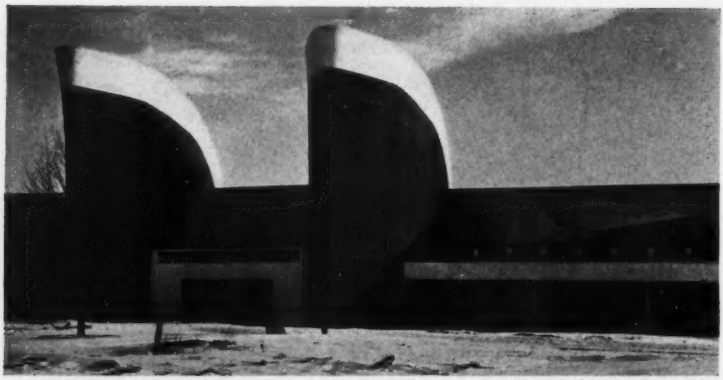
Building Construction.

The general type of construction is largely combustible, but exterior walls are finished with stucco on plaster base or wire lath. Fires of magnitude are possible in an individual building, but it is felt that because of the exterior finish, limited height of most of the exhibition buildings and the spacing of most of the buildings in blocks varying from 200 ft. in width to a minimum of about 100 ft., together with the proposed fire alarm and extinguishing equipments, the possibility of conflagration, except under extremely abnormal conditions, is remote. There is an excellent break in the fire area between the main section of the exhibition buildings and the Amusement Section, consisting of Horace Harding World's Fair Boulevard with a width of 200 ft. or more. On the main exhibition grounds, there exist at least five definite breaks of 200 ft. or over in the fire area, but in the Amusement Section there appears to be only one definite break of not less than 200 ft. in the fire area.



Architect's drawing of the New York State buildings at the Fair. The stage of the amphitheatre, a permanent structure which will seat 10,000 persons, is 60 feet from the shore of Fountain Lake. Beneath the tiers of seats will be housed exhibits of the various state departments.

The greater portions of the fire areas have structures 1, 1½ and 2 stories in height, of unprotected steel frame with wood studding. The exteriors are finished with stucco on plaster base or wire lath. The interior finish is combustible, having varying types of wall boards, or plywood. Side walls are fire stopped at the ceiling of each story, but the interiors are of large areas, not subdivided by fire or division walls, with concealed spaces between floors and ceilings and in blind attics, used for ventilating and air-conditioning purposes. These not only would facilitate the rapid spread of fire, but the large amount of combustible framing in the spaces would add to the intensity of the fire. The buildings for the most part are without window or other openings, except for door openings on the grade floor, and access to the interior for the operations of the Fire Department would be difficult. There are, of course, a few structures of fire-resistive or incombustible construction, as well as some special structures of considerable height, such as the Trylon and the Perisphere, where special safeguards are or will be employed. The Amusement Section is still largely under construction, but it is said that structural conditions will parallel those of the main exhibition buildings. An interesting special feature from a structural standpoint is that area known as "The Court of States." These



The Marine Transportation building will house exhibits of the maritime industries. The twin prows rise 80 feet from the ground, which is 30 feet higher than the bow of the liner "Normandie."

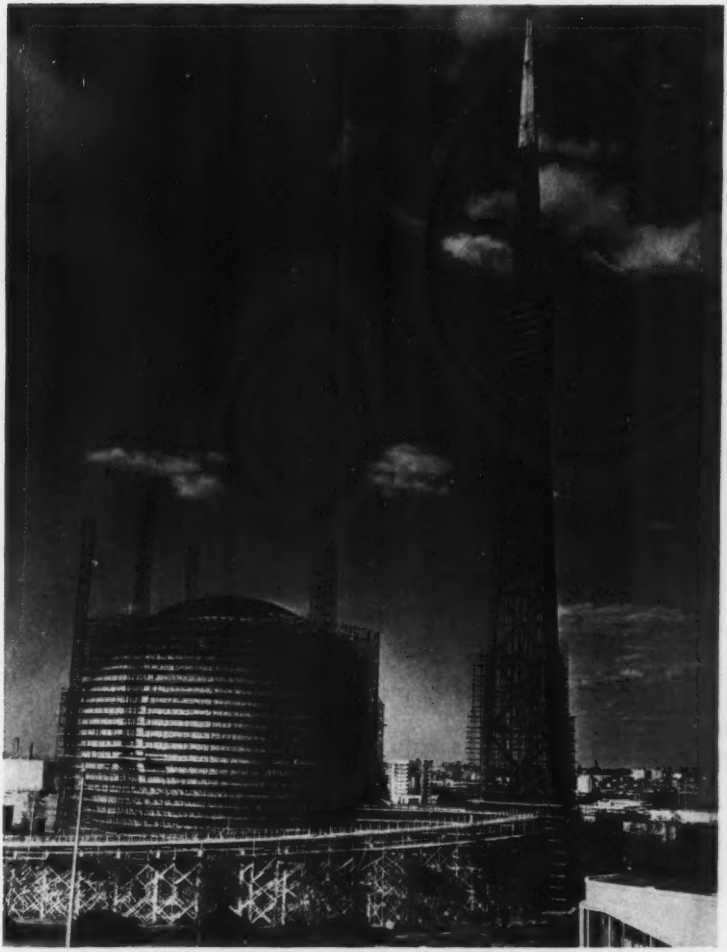
structures are built above the Flushing River on wood piling, the river being temporarily drained of water during the construction period, and through the middle of the Court (also above the river) is a wooden boardwalk. The width of this walk varies from about 150 to 200 ft., while its length is about 1000 ft. The sub-structures of the buildings and the boardwalk are similar to the sub-structures in pier and wharf construction, and since it is very important to safeguard the hazard of a fire gaining headway in such sub-structures, fire stops have been installed in foundation lines of most of the buildings and plans are now under way to provide fire stops at intervals of about every 200 ft. in the boardwalk sub-structure.

Provisions are being made to establish three parking areas to accommodate approximately 35,000 automobiles. The largest area is to accommodate about 22,000 cars. The water mains are being extended to these areas and some form of satisfactory operating equipment is to be provided.

Fire Department and Water Supply.

The main trunk lines consist of a 48-in. main at Horace Harding World's Fair Boulevard and a 20-in. main near and paralleling Northern Boulevard, both installed in compliance with the specifications of the Department of Water Supply, Gas and Electricity of the City of New York and connected to the mains of the Catskill Water Supply. The branch lines are installed by the Corporation and consist mainly of transite pipes with some cast iron and steel pipe.

The Fire Department of the City of New York assumed jurisdiction over the extinguishment of fires on the exposition grounds, and early in the construction period assigned two engine companies. The full equipment will consist of two 1000-gallon and three 500-gallon pumpers with a personnel of three bat-



The Theme Center of the New York World's Fair during construction. The scaffolding was of steel and flameproof planking.

talion chiefs, two captains, fifteen lieutenants and ninety-eight firemen. There are three engine houses located within the Exposition grounds, while a fourth is located directly adjacent thereto.

In addition to the Fire Department there is a Fire Prevention Department under the command of a retired chief of the New York Fire Department. The members of this Fire Prevention Department are assigned to make inspections of all buildings, to regulate the hazards thereof and to become familiar with

the structural details. Unsatisfactory conditions are reported to the chief of this department and corrections are usually secured promptly.

Fire Alarm System.

The street boxes and interior alarm systems are of the manually operated type, with direct communication to Fire Alarm Headquarters. Automatic fire alarm systems are installed or expected to be installed in most of the large exhibition structures controlled by the World's Fair Corporation. Also a number of private exhibitors' structures are or will be similarly equipped, but there is a significant number of such structures where final determination of this protection is still pending. Included in the latter is the Federal Building of the United States Government where there is no automatic means of transmitting a fire alarm. It is expected that a few of the structures will be fully equipped with automatic sprinklers. So far as is known at this time there will be practically no automatic fire alarm systems installed in the Amusement Section of the Fair.

It is stated that the corps of guards, special policemen, guides and other employees in uniform (to be about 3000 in number) will be trained to transmit fire alarms and clear the roadways to facilitate the operations of the fire department. Considerable first aid fire equipment is located throughout the various buildings and several of the towers and blind attic roof spaces are protected by sub-standard automatic sprinkler systems.

Fire Record.

During the early construction period it was found that refuse and débris were allowed to accumulate in considerable quantity within a structure then in course of erection. This situation, which has been one of the leading causes in the spread of fire during the construction period, was forcibly brought to the attention of the authorities of the World's Fair. Since that time extreme care has been exercised to keep structures free from the accumulation of combustible débris and rubbish, and undoubtedly this has been one of the cleanest operations from that standpoint that has occurred in a considerable period of time. In most buildings over 75 ft. in height, steel scaffolding and flameproof planking were used during the construction period, and similar precautions were taken on the interior of large area buildings of lesser height. One large structure where these precautions were not taken, and which caused considerable uneasiness for the period of its erection, was controlled by the United States Government and, therefore, beyond the jurisdiction of the Fair authorities. The illustration on the preceding page shows the steel scaffolding and flameproofed planking in place during the construction period at the Perisphere, a structure about 200 ft. in diameter, and at the Trylon, a tower approximately 700 ft. in height. Without question this framework was the largest structure of steel scaffolding and flameproofed planking that has ever been erected. It

is stated that approximately one million board feet of flameproof planking was used. The World's Fair Corporation was fully justified in taking these precautions during the construction period, as a major fire might easily have caused such extensive damage that the structures could not have been put back in suitable condition to serve the purposes of the exposition in time for the opening.

There have been two fires involving considerable loss. The first occurred in a temporary frame building housing building materials, and may have been due to carelessness, probably smoking. The other fire occurred in a structure that was nearly completed, which was being joined by a ramp to the subway system. The cause of this fire has been ascribed to electrical conditions. There have been a number of small fires attributable to the carelessness of workmen, but not unlikely to occur during the construction period of buildings, such as roofer's tar pots, careless smoking, plumber's torches, acetylene welding, etc. There have also been two fires involving electrical transformers and two others caused by windstorms.

Kansas City, Mo., Fire Station Explosion.

By A. T. Waterman,
Missouri Inspection Bureau (Member N.F.P.A.).

An explosion and flash fire from gasoline being used for washing a kitchen floor caused the deaths of two firemen and serious injuries to four others at Fire Department Station No. 3, Kansas City, Missouri, on February 23, 1939. The investigation by Fire Department heads found that there had been a direct violation of the rules of the Department against the use of gasoline for anything except motor fuel. In spite of this rule and the special knowledge of the dangers of gasoline possessed by experienced firemen, the unfortunate victims apparently chose this method of cleaning because they considered it easy and convenient.

Construction and Occupancy.

The fire station involved is a two-company house quartering a hose company, a ladder company and a district chief. The building is of brick construction, with a concrete first floor and wood-joisted second floor and roof. A small basement contains a heating boiler. Above the basement portion there is a kitchen for the use of the men, situated in a corner of the first floor. The kitchen is separated from the apparatus floor by brick partitions four feet high with screen wire above the partitions to the ceiling. Two gas stoves with pilot lights, a cupboard and a table comprised the furnishings of the kitchen. A gas flame about four feet above the floor was also located in the kitchen for use in lighting pipes and cigarettes.

Story of the Fire.

On the morning of February 23, the day shift reported at 7 o'clock and shortly afterward began the routine morning clean-up. Three men undertook to remove grease spots from the concrete floor of the kichen. They were said to have drawn about one gallon of gasoline from the fire station fuel pump into an ordinary water pail. This was poured out on to the floor and two of the men used straw brooms to distribute the fluid and rub the spots.

About 7:30 A.M. the explosion occurred, knocking the men to the floor and enveloping them in the burning liquid. A captain and two firemen just outside the kitchen rushed into the room, dragged the men out and wrapped them in fire coats to smother the flames. One of the rescuers' clothing became ignited. He ran out a door in panic and had to be caught and rolled to extinguish the flames. A garden hose used for apparatus washing was turned on the victims, but in spite of these prompt measures two of the men who were in the kitchen died from burns within a few hours. Two other firemen, including the rescuer who ran out with his clothing ignited, were critically burned, but will recover. Severe burns were suffered by two other firemen who aided in the rescue, but they have returned to work.

No structural damage resulted to the kitchen and no fire of any consequence ensued. A pair of large apparatus doors at the rear of the station were blown open with enough force to break the glass in them and to dislodge them from their hinges.

Conclusions.

No new lesson relative to the hazards of gasoline may be learned from this occurrence unless it be to show what little chance ordinary persons have when using gasoline for cleaning, if firemen surrounded with fire fighting and rescue appliances and with immediate help available can lose their lives so quickly. It also indicates that the general hazards of gasoline vapor were not properly appreciated even by the firemen themselves, although special emphasis had been given in the fire department orders against the use of gasoline for cleaning when a fireman was injured in a similar accident at another station two years before.

Dwelling Inspections by Fire Departments.

A Report of Progress.

Home fires present the most tragic aspect of the national fire loss. More than half of all fires occur in homes and more than two-thirds of the losses of life and personal injury by fire. These fires cause untold suffering in the disruption of homes and frequently destroy irreplaceable personal possessions.

It is estimated that there are some 28,000,000 homes in the United States and Canada. Estimates based on fire marshals' reports indicate that in recent years the number of dwelling fires in the United States has averaged about 350,000 annually, with a property loss of about $100,000,000. In Canada there is an average of about 50,000 dwelling fires annually, with a loss of some $8,000,000.

Because of the magnitude of the problem and the relative small units involved, the measures of fire prevention and fire protection that have been applied to industrial, mercantile and public buildings have only to a very limited extent been applied in homes. The principal causes of dwelling house fires are such readily understood and controllable causes as overheated or defective chimneys and flues, defective electric wiring, careless use of matches and careless smoking, misuse of flammable liquids, sparks on wooden shingle roofs, improperly designed and protected stoves and furnaces and careless disposal of hot ashes and rubbish.

Because of the growing interest in home fires and fire hazards it was decided last Summer to attempt to focus attention of the whole country by a concerted effort during Fire Prevention Week on the importance of the dwelling house fire loss and the desirability of dwelling house inspections by firemen. Emphasis on dwelling house inspections was stressed in the Fire Prevention Week program carried on by the N.F.P.A., the National Board of Fire Underwriters, the International Association of Fire Chiefs, the Fire Waste Council of the Chamber of Commerce of the U. S., the Western Actuarial Bureau, and others.

To secure some measure of the effectiveness of this appeal and the general acceptance of the idea of dwelling house inspections by firemen the N.F.P.A. Executive Office has made a survey of the situation in January, 1939, in all of the larger cities and the data are summarized herewith.

For previous articles on this subject see "Dwelling House Inspections," October, 1929, QUARTERLY; "Providence Inspects Its Homes," January, 1931, QUARTERLY; "Dwelling Inspection by Fire Departments," April, 1936, QUARTERLY.

Boston firemen made 151,605 home inspections in 1938, covering every part of the city. Not one refusal of entry was experienced by the firemen. The fire department has been so pleased with the results that the inspection campaign will unquestionably be made an annual affair.

NEW YORK CITY has done some work along this line. In March, 1934, in coöperation with the Tenement House Department, the Fire Department of New York entered into an extensive campaign to correct or eliminate hazardous conditions in tenement houses in an effort to reduce the large number of fatal fires that were occurring in those buildings. Approximately 30,000 tenement house inspections were made by members of the uniformed force. Inspections of tenement houses for the removal of rubbish and other common hazards were continued from 1935 to 1936. A total of 121,000 inspections were made and over 16,000 fire hazards were eliminated.

BOSTON is the largest city that has carried on a complete dwelling house inspection campaign. This was conducted under the supervision of Fire Commissioner William Arthur Reilly and Chief Samuel J. Pope during the fall of 1938. The following quoted from the report of Fire Commissioner Reilly to the N.F.P.A. on December 20, 1938, is interesting.

"There were 151,605 home inspections made during the campaign; 31,453 fire hazards were corrected at the time of the inspection and 10,133 additional hazards were ordered corrected by written notice. The home inspections covered every part of the city. They were made block by block. The outside of all buildings was first inspected and after this the inside of the buildings was inspected from cellar to roof. Excellent coöperation in this campaign was forthcoming. The really astounding fact in the whole report is that not one refusal of entrance was experienced by any fireman. Apparently if they did not wish to let the fireman in they did not come to the door, thus the report was recorded as being 'vacant' at the time of the visit."

The experience in other large cities that have tried out the dwelling inspection idea may best be presented by direct quotations from reports received in the N.F.P.A. office.

CINCINNATI. Report from C. M. Stegner, Commissioner of Buildings:

"Dwelling inspections have been carried on in Cincinnati for the past twelve years. All resident buildings in the basin of the city are inspected annually by building inspectors for maintenance. All other dwellings throughout the city are inspected annually by firemen. These inspections are not confined to the basement, but include the entire building."

OAKLAND, CALIF. Report from Fire Marshal Fred Carlson:

"The City of Oakland is divided into districts, each district being covered by an inspector from the fire prevention bureau. We are trying to have the inspector in each district visit every building in his district and offer his service to the home owner or occupant in eliminating fire hazards. We believe that the only way we will eliminate fires in the home is through personal contact with the home owner. We have received wonderful results through this procedure."

SYRACUSE, N. Y. Report from Chief Edward W. Gieselman:

"I am heartily in favor of the movement under which fire prevention inspections are carried into the home. We do not have an ordinance authorizing such inspections. However, we have developed a program which seems to work out quite satisfactorily whereby firemen are sent to the residential districts. They visit the homes and ask consent of the home owner to make inspection of buildings, especially the basement. During these visits the firemen leave with the property owners Fire Prevention Week literature issued by the N.F.P.A. and National Board. While we do not have a complete record of the number of such inspections, the firemen report that on the whole they were cordially received by the home owners. A number of fire hazards were detected and that the program registered favorably is evidenced by the fact that there were innumerable inquiries from home owners hearing of this innovation asking the department to make inspection of their homes."

SOMERVILLE, MASS. Report from Deputy Chief H. W. Hutchins:

"The Somerville Fire Department organized a fire prevention bureau in 1924 and have carried on systematic inspection ever since. During 1938 there were 18,031 inspections throughout the city, of which approximately 16,000 were in dwellings. We received a fine response to the campaign and the moral effect on the occupants and property owners of knowing that a uniformed fireman was periodically making inspections without doubt caused better housekeeping conditions than would otherwise exist."

GRAND RAPIDS, MICH. Fire Chief Fred Higgins reports:

"We have done house to house inspection work by uniformed members of the fire department continuously since 1916. Our inspections before our force was reduced amounted to well over 100,000 a year. We believe that our only hope in keeping up with fires is to continue this kind of inspection work."

The Providence Fire Department not only inspects all dwellings each year, but during Fire Prevention Week invites its citizens to an interesting and educational exhibit illustrating home fire dangers. The old fire truck used as a float is part of the program to create public interest in the dwelling inspection campaign.

BRIDGEPORT, CONN. Report from Chief Thomas F. Burns:

"Each engine house in this city is assigned a certain district to cover twice a month. This gives both platoons an inspection to make once a month. This inspection covers all of the dwellings, as well as business establishments. Such inspections have been in practice in this city for some time and we find that there is no question but what they eliminate a great many hazards."

DAYTON, OHIO. Report from Chief Inspector R. B. Kurfiss:

"We have successfully adopted dwelling house inspections since the inauguration of our Bureau of Fire Prevention in 1914. This inspection work has been entirely satisfactory. For the first 11 months of 1938 we conducted a total of 11,902 inspections, 60% of these representing dwelling inspections. In years past the authority of the Bureau of Fire to inspect dwelling houses and order correction of hazards to be made has been questioned. In each instance the court upheld the order issued by the bureau."

SPRINGFIELD, MASS. Report from Chief Inspector L. A. Huntoon:

"Our home inspection campaign has been a great success. By this method we have reduced and eliminated thousands of potential hazards incidental to the home. The following figures will give you an idea of the results obtained:

Year	Number of Fires	Loss
1930	202	$173,000
1931	198	168,000
1932	174	146,000
1933	181	125,000
1934	151	106,000
1935	152	74,000
1936	156	67,000
1937	150	61,000

"In 1931 we started our home inspection campaign; 23,523 inspections were made with only 18 refusals. Advance information on the campaign was given out over the radio and in the newspapers. Attention was confined to the basement of homes and in the vast

majority of the cases the visit of the fireman was anticipated by cleaning up. The common hazards found were waste paper and rubbish stored in wooden barrels, storage of waste materials under stairways, smokepipes too near woodwork, old furniture and paint cans allowed to accumulate, defective heating equipment, old newspapers and magazines, defective wiring, ashes on the floor; accumulations of old wearing apparel and furniture stored in the attic was the principal hazard. In our campaign we gave special attention to the storage of fuel oil. Many leaky drums and faucets were replaced. Defective chimneys were noted and repaired; leaves and brush were cleaned up from around wooden buildings."

WILMINGTON, DEL. Report from Fire Marshal George T. Morgan:

"We have twelve companies in our city and each platoon of the 12 companies while off duty inspects every dwelling in its district twice a year. Reports are forwarded to the fire marshal's office giving the number of inspections and hazards found and the follow-up work is done by the fire prevention bureau. During Fire Prevention Week 1938 the various fire companies inspected 34,364 properties."

QUEBEC, P. Q. Report from Chief Rosaire Beaulieu:

"Starting during Fire Prevention Week all firemen make inspections of private houses. They pay special attention to the cellar and the attic. Every morning they report their inspections of the day before and at every home where a hazard has been noted an inspector of the fire prevention bureau is sent. Last year the firemen made 22,864 inspections and the fire prevention bureau inspectors made 8967 inspections. We have noticed a substantial reduction in fire losses in dwellings since we started these inspections."

FORT WORTH, TEX. Report from Fire Marshal Claude Ligon:

"Our first dwelling house inspection campaign began during Fire Prevention Week, 1934, and ended in February, 1935. We inspected 23,904 dwellings and 16,674 outbuildings; 21,608 potential hazards were found and recommendation made for correction. The next home inspection campaign was carried on beginning Fire Prevention Week, 1938. Inspections of 24,087 dwellings were made."

Mr. Ligon submits the following tabulation of dwelling losses in the city as proof of the value of this inspection work:

Year	Number of Fires	Loss
1931	513	$756,000
1932	415	510,000
1933	361	330,000
1934	302	202,000
1935	270	148,000
1936	354	204,000
1937	247	137,000

NEW HAVEN, CONN. Report from Fire Marshal Paul P. Heinz:

"The New Haven Fire Department has carried on dwelling inspections in this city for the past thirty years. In this city we have 16 engine companies and 6 truck companies, and a man from each company each day is detailed to inspection work. Dwelling houses are checked twice a year, in the spring and fall."

MINNEAPOLIS, MINN. Report from Arthur P. Spottswood, Chief, Fire Prevention Bureau:

"A special W.P.A. fire hazard survey has been instituted in Minneapolis and this survey covers all buildings, including dwellings, in a large section of the city. This survey has been well worth while and we feel that the benefits received should be extended to the entire city. Funds have been provided to carry on this work on a city-wide basis. A large number of fire hazards in homes have been discovered and corrected as a result of this survey."

HARTFORD, CONN. Report from Chamber of Commerce:

"Hartford inspects all dwellings twice a year. Inspections are made primarily in the basement. The work is carried on under the direction of the fire prevention bureau. During the last fiscal year the department made 76,788 inspections. Excellent coöperation from the public is reported."

DALLAS, TEX.

"Dwelling inspections were carried on in this city for six years from 1930 to 1935 inclusive. During the period the number of dwelling fires showed a decrease from 642 to 413 and the amount of the dwelling loss from $849,000 to $265,000." Chief Hansen advises that they did not make a dwelling inspection campaign in 1938 because they wanted to make a

A Cincinnati Fire Department inspector found five rooms in this house in condition similar to that shown above. Broken furniture, cast off clothing, household utensils, old papers and almost every conceivable kind of junk was found in these rooms. The lower picture, taken from the same point, shows the results secured. Twelve men were given work and fourteen truck loads of rubbish were removed in cleaning up this one house.

change. He said, "We feel that our losses have been quite materially decreased as a result of these inspections and we furthermore dislike to provoke displeasure of our citizens by entering their homes so often. We have not given up the idea."

LYNN, MASS. Captain John H. Day, Chief Inspector, Bureau of Fire Prevention:

"Lynn makes three dwelling house inspections a year. The first is made shortly after the first of the year to see that holiday decorations and Christmas trees are removed; the second just before the Fourth of July and the third during Fire Prevention Week."

DETROIT, MICH. Report from Fire Marshal Otto Lindemeyer:

"Detroit has obtained a grant of $90,000 from the W.P.A. to form a group of workers to call at every home in the city (over 300,000) to distribute fire prevention literature and to talk with the householders about fire hazards. This project is just getting under way. The workers will not be permitted to enter the homes, but will stay outside."

OTTAWA, ONT. Report from Fire Department:

"In Ottawa we have been doing this class of inspection work since 1932. A house to house inspection has been carried on each year beginning Fire Prevention Week."

CAMBRIDGE, MASS. Report from Chief Herman H. Gutheim:

"On September 19, 1938, I issued a general order to all company commanders to inspect all dwelling houses for electric wiring, accumulations of rubbish, etc., and to report to me any refusal of occupants or owners. To date (December 30, 1938), reports have been made of 3828 dwelling house inspections and no fireman has been refused admittance to any home."

BIRMINGHAM, ALA. Report from Chief A. Brown:

"In 1938 we conducted an inspection campaign to cover every dwelling house within the limits of this city. We are pleased to advise that firemen both on duty and off duty made a total of 30,691 inspections. The campaign of dwelling house inspections was begun

about the first of October and was concluded in December. We can state that we have had wonderful results in this campaign and expect even better results in the future."

WORCESTER, MASS. Report from Chief Walden of the Protective Department:

"The fire department began the annual dwelling house inspection campaign in 1932. In the spring of each year the members of the fire department make these inspections. About 24,000 such inspections are made annually."

In 1932 Worcester had 910 dwelling fires with a loss of $330,000 and in 1938 there were 780 dwelling fires with a loss of $130,000.

ST. PAUL, MINN. Report from W. C. Barron, Chief Inspector:

"Home inspections were made by the captains of the various fire companies for eleven weeks from September 19 to December 10, 1938. A total of 49,262 such inspections were made; 386 refusals were noted. Most common defects found in this inspection were rubbish—693 cases; defective heating appliances—594 cases; defective electric wiring—289 cases and poor storage of ashes—242 cases."

SAN ANTONIO, TEX. Chief J. G. Sarran reports:

"For the past several years we have been educating our public that most fires are in the home, and inspecting mostly on request of the home owner or occupant. In the past year we have made very extensive inspection of dwellings with very good results. Some 55,000 dwellings were inspected this year and we are going to repeat this work each year. Our representatives are schooled before they are permitted to call upon the home owners. They are taught that this is only a good will visit to familiarize the occupant with fire causes, keeping in mind that the desire is to help and suggest rather than direct."

ATLANTA, GA. Report from Assistant Fire Marshal Harry Phillips:

"In 1930 the fire chief detailed 30 men who spent about six months making house to house inspections. They also made out a card for each piece of property in the city. There are 70,000 of these cards, which are used by the fire inspectors in making permanent record of daily inspections. It was the intention to continue to inspect private properties regularly each year, but in January, 1931, the personnel of the department was cut to the point where it was impossible to detail men for this purpose. We have, therefore, been unable to continue this work."

NORFOLK, VA. Report from Chief R. S. Baughan:

"We carried out a dwelling house inspection campaign in the spring of 1938 which ran well into the summer. Such inspection work was done by fire and police men working together. Wonderful results were obtained, especially in our colored districts. These inspections resulted in showing the occupants how to keep their premises tidy and were the cause of the removal of many fire hazards. It is possible that we will conduct another inspection of this kind again this year."

ST. LOUIS, MO. Report from Chief Lawrence Cornoyer:

"In February, 1939, I inaugurated an intensive inspection of rooming houses and residences used for light housekeeping. In two weeks the department inspected 1751 buildings of this type. The reaction from this inspection has been noticeable in the enthusiasm displayed by officers and men in the department. Many fire hazardous conditions have been corrected to date."

HONOLULU, T. H. Report from Chief W. W. Blaisdell:

"While this department has no jurisdiction over the interior of private homes, it was felt that inspection of homes by men in the department would decrease the number of dwelling house fires. During December, 1938, 2403 homes were inspected and only one refusal was encountered. It is the intention of this department to inspect every home in the City of Honolulu."

AKRON, OHIO. Report from Park L. Roberts, Public Relations Bureau, Fire Department:

"We have had in force in Akron a modified form of inspection of dwellings since 1936. We have enrolled thousands of boys and girls in our Junior Fire Fighters Club, where the members of the club become familiar with fire hazards in their homes. It is their duty to inspect their home once each week. We have found that they do conduct these inspections religiously. In this way we have been able to maintain an inspection of more than half of our homes once each week throughout the year since 1936."

The St. Paul Fire Department made 49,262 dwelling inspections in the Fall of 1938. The picture shows a fire department inspector pointing out a large crack in a chimney dangerously near the roof line. This defective chimney had no flue lining.

PROVINCE OF ONTARIO. Report from Fire Marshal W. J. Scott:

"It is a common practice throughout Ontario for fire departments to inspect all dwelling houses. The Ontario Fire Marshal Act specifically gives the power to fire departments to inspect private houses for fire hazards."

There are a large number of smaller communities that have conducted dwelling house inspection campaigns with marked success. It is impossible to record all such communities, but among the cities that we know definitely that are carrying on this sort of work are the following: Arlington, Mass.; Baton Rouge, La.; Berkeley, Cal.; Brockton, Mass.; Chelsea, Mass.; Cleveland Heights, Ohio; El Dorado, Ark.; Everett, Mass.; Fitchburg, Mass.; Fort Collins, Col.; Helena, Ark.; Irvington, N. J.; Jonesboro, Ark.; Little Rock, Ark.; Lynchburg, Va.; Malden, Mass.; Meriden, Conn.; Middletown, Conn.; Middletown, Ohio; Newport News, Va.; Parkersburg, W. Va.; Peabody, Mass.; Pine Bluff, Ark.; Portsmouth, Ohio; Salem, Mass.; Schenectady, N. Y.; Taunton, Mass.

A considerable number of the larger cities have reported that they are interested in dwelling house inspection work. Some of the comments of this group will prove of interest.

CANTON, OHIO. Chief Geo. E. Jacob:

"I think that inspections of basements of private dwellings are entirely feasible. Earlier attempts at home inspections were not successful because they were carried on in a manner to arouse the resentment of the citizens. I intend to start dwelling inspections. I think it will mean a reduction in our fire loss."

YONKERS, N. Y. Chief John J. Riley:

"I believe the idea of having firemen make inspections for simple common fire hazards in the basement of all dwelling houses is very good."

BUFFALO, N. Y. Chief W. R. Castimore:

"The only dwelling inspections in the past have been on complaints. Our bureau of fire prevention which we have just established is hardly able to get under way on this, but we realize the great number of fires and losses occurring in dwellings and I am very much in favor of dwelling inspections. I believe that the people of Buffalo will have to be educated to this idea, but I am in hopes that in the not too distant future we will secure the necessary coöperation on this, which will permit us to carry on the important work."

WASHINGTON, D. C. Fire Marshal Calvin G. Lauber:

"I am firmly convinced that much good could be accomplished by dwelling house inspections. We do not regularly inspect dwellings except on complaint. At present, however, in Washington an exceptionally large proportion of our population lives in multi-family dwellings which are inspected."

CHICAGO, ILL. Deputy Chief Anthony Mullaney:

"Chicago's ordinance does not provide that inspection of homes be made, but if called upon by the occupants or property owners our fire prevention bureau renders this service. Our fire prevention bureau is aware of the mounting number of deaths resulting from fires in dwellings and we have made efforts to present advice and information through the public schools and parochial schools on this subject so that the children could take the literature home. We feel that our attempts to prevent fires in the home through this and other mediums have great merit."

PITTSBURGH, PA. Chief Nicholas Phelan:

"I am very much interested in the inspection of homes, for it is only common sense to inspect the type of building in which the greatest number of fires occur in Pittsburgh. We inspect buildings only when complaints are received. This is not sufficient, but as our force is undermanned and I have never been able to have the fire prevention bureau re-created, this work is not possible. I am very much in favor of this fire prevention work and if I could would have every building in the city inspected at least twice a year."

COLUMBUS, OHIO. Chief E. P. Welsh:

"We have done some dwelling inspection work several years back, but due to decrease in our personnel it was impossible to carry this on. I am a firm believer in that type of inspection and if the personnel had been continued would have adopted inspections of dwellings before now."

YOUNGSTOWN, OHIO. Chief Herman Steinfurth:

"We have been unable to set up a force of inspectors for home inspections, but it is our intention to carry out this work in the future."

FORT WAYNE, IND. Inspector Arthur Kramer:

"The subject of home inspections has been somewhat controversial. A city-wide program of this kind was formerly carried out here and we believe results obtained were quite satisfactory. At present we only inspect homes on complaint."

UTICA, N. Y. Chief J. N. Sullivan:

"I am sorry to say that our fire prevention law does not give us authority to make inspections except on complaints. However, I have been very much in favor of home inspections for a number of years. I believe it requires that the public be educated so they will understand it is for their own good. We have had our firemen visit homes during Fire Prevention Week and have received some requests for home inspections, but not to the amount that I would like to see."

LOWELL, MASS. Chief James C. Sullivan:

"Home inspection work has my wholehearted approval. Such a campaign as was con-

ducted in Providence has never been attempted in this city, but I firmly believe that the conditions in dwellings as were discovered and corrected by that campaign materially reduced fire hazards in the homes."

LOUISVILLE, KY. Assistant Chief S. G. Render:

"We are now training a group of men to make house to house inspections after considerable newspaper publicity and talks over the radio. The city will be divided into seven sections and one section assigned to each man. This department, like many others, can see the need for this service."

SALT LAKE CITY, UTAH. Chief W. S. Knight:

"We are heartily in accord with the idea of dwelling inspections. Our department has done considerable work in rehabilitating toys for Christmas and when we review the large amount of junk that we accumulate at this time we cannot but feel that home inspections would be in order. We do receive a few such calls for inspections, but our experience has been that unless we do receive such calls the attitude of the householder is not very cordial."

SCRANTON, PA. Chief John Griffiths:

"My firm opinion of dwelling house inspections is that they are feasible and should be carried on in every city. You are assured that our department will coöperate with you to the fullest extent."

Nearly all of the larger cities that do not carry on home inspections on a wholesale basis do make such inspections upon complaint or upon request of the home owner. Definite advices to the effect that such inspections are made have been received from such cities as Richmond, Va.; Tacoma, Wash.; Baltimore, Md.; Atlanta, Ga.; San Francisco, Calif.; Wichita, Kansas; Rochester, New York; Duluth, Minn.; Knoxville, Tenn.; and Indianapolis, Ind.

There are some fire authorities who do not think that home inspections are desirable or feasible. Perhaps the most interesting comment along this line was received from Chief James E. Granger of the Fire Department of Cleveland, Ohio. Chief Granger says the following:

CLEVELAND, OHIO:

"Regarding the possibility of firemen making inspections of basements of dwellings I would state that this would be absolutely out of the question. In the first place, firemen, other than officers and members of the fire prevention bureau, are not trained for inspection work and would fail to recognize fire hazards in dwellings. Furthermore, 90% of the occupants of the dwellings would strongly object to members of the fire department entering their homes for the purpose of making inspections. I feel that I must state that any steps covering the routine inspection of any portion of the residential occupancies would meet with my disapproval."

SAN DIEGO, CAL. Fire Marshal E. R. Newton makes an interesting comment:

"We do not make systematic inspection of dwellings nor do I think it is necessary or feasible. We do make a large number of dwelling house inspections in connection with the installation of oil burners. Most of our dwellings have no basements, so that hazard is eliminated. To make a complete inspection of dwellings would require the use of all members of the fire department. My experience over twenty years is that the idea that the average fireman can go out and do effective fire prevention work on his day off is a mistaken one. These are my conclusions for San Diego. For other cities such inspections may be desirable and necessary."

SEATTLE, WASH. Chief William Fitzgerald:

"Seattle does not have dwelling house inspections. Practically the only dwellings inspected are those where fires have occurred. It does not appear feasible to go into the general campaign of dwelling inspections in this city. The manpower is one of the drawbacks to such a program and it seems hardly fair to make firemen conduct such campaigns in their off-duty time. I realize that this has been done in some cities, but does not appear practical for Seattle."

MILWAUKEE, WIS. Eugene Hackett, Chief of Fire Prevention Bureau:
"The exterior of private dwellings and surroundings are inspected twice a year. I am not in favor of the inspection of interiors of private houses in this city."

TRENTON, N. J. Chief Thomas J. Phelan:
"While I am of the opinion that dwelling house inspection is desirable, I feel that other inspections, for example, theatres, mercantile establishments, etc., would suffer unless we were in a position to increase the personnel for this purpose. Due to economic conditions existing at present it would be impossible to undertake any such inspections as a regular routine in this department."

LONG BEACH, CALIF. Chief Hugh Etzell, Fire Prevention Engineer:
"We have very few homes with basements, consequently very few basement fires. Also as paper and rubbish are collected once a week free of charge we do not have many fires caused by rubbish. Such an inspection would be ideal provided a sufficient number of qualified inspectors were available. However, we do not have enough inspectors to follow any regular procedure on dwelling house inspections."

Reducing False Alarms in Boston.

By Wm. Arthur Reilly (Member N.F.P.A.),
Fire Commissioner, City of Boston.

During the year 1938 nearly every large city in the East reported an increase in false alarms. Such a trend deserves consideration and action by citizens in general and by fire authorities in particular.

It would appear that the gravity of this situation is not appreciated by many persons. Lest there be any doubt as to this, let us enumerate some of the more serious consequences which may result from a false alarm. First there is the hazard which always attends the rapid passage of fire apparatus through traffic. Obviously, when fire apparatus goes out onto a congested city street, there is always the possibility that something may happen which will cause discomfort, inconvenience, suffering or even death to persons using the streets.

In small or medium-sized communities the size of the fire department is often no larger than is absolutely necessary to provide a modicum of fire protection; it may consist of but one or two companies. Imagine the serious consequences which might result if, while the entire department was responding to a false alarm, a fire occurred at the other end of town. On holidays such as Hallowe'en a series of false alarms in a large city has been known to put as much as 50% of the total available apparatus onto the streets at one time.

It is doubtful if the expense connected with the actual responding to alarms is of much concern to most fire departments. Men are always on duty in the average city fire departments and fire apparatus, like any other, is designed for use. But every unnecessary alarm adds to the wear and tear on both manpower and apparatus.

To reduce the frequency of false alarms a sustained program is necessary. With the coöperation of civic societies, parent-teachers' associations and school authorities, a continuous "long-term" process of education should be provided.

Such a plan, based upon six steps, has been prepared for the current year by the Boston Fire Department. In case of apprehension and prosecution of an adult for sounding a false alarm, to establish the fact that the person sounding the false alarm had a reasonable means of knowing that he was guilty of wrong doing, a decalcomania strip has been designed, bearing an imprint similar to that which is found on mail boxes, issuing a warning that the sounding of a false alarm or tampering with an alarm box is punishable by a fine not exceeding $500 or two years in jail, or both.

Mechanical sirens for fire alarm boxes have been provided. These are portable, and can be placed on certain so-called "bad boxes." The operation of these sirens is entirely mechanical. They do not depend on the electrical circuit. A wire is placed under the hook, connecting to a hand-wound spring. When the hook on the fire box is released, the spring is released, setting off the siren. The noise will instantly call attention to the fact that the fire box has been used. The noisemaker will not begin to operate until the hook has actually been pulled, so there is no danger that a person will be led to believe that he has sounded an alarm prior to the actual pulling of the hook. Furthermore there is nothing about such equipment which discourages a person from using a fire alarm box. A person sounding a genuine alarm will not care who knows he sounded it. A person sounding a false alarm, if not immediately discovered, may be discouraged from going to another box immediately and repeating the act. The most important part in this section of the program is that the use of the firebox is instantly made known to those in the neighborhood. The Chief's driver rewinds the spring when he arrives at the box so that it is ready for operation once more should the hook be pulled later.

By means of a daily check-up on the number of false alarms and the location of the source of false alarms by telephone, the Police Department can be notified to give special attention to the situation in specific districts. Local prowl cars and policemen are thus reminded when a false alarm wave is taking place in their own districts.

District Chiefs and speakers representing the Fire Department are encouraged to appear before women's clubs, parent-teachers' associations, civic societies, and youth organizations, for the purpose of emphasizing the dangers resulting from the sounding of false alarms. In connection with this step, motion pictures and interesting stories are provided to assist the speakers so that their talk may be an attraction and not a bore to the audience.

A motion picture dramatizing the possible experience resulting from the sounding of a false alarm is to be provided for use by teachers in the public and parochial schools. Following each showing a talk is to be given to the pupils either by the headmaster, a teacher (or a representative of the fire department provided none of the educational authorities are equipped to properly discuss the false alarm problem).

The Registrar of Motor Vehicles has agreed to suspend or revoke the license of any automobile operator found guilty of aiding in transporting persons sounding false alarms.

The local District Attorney has agreed to present a charge of manslaughter against any person sounding a false alarm as the result of which some fatal accident takes place.

These points embracing both educational and law enforcement activities may not be complete, but each supplements the other in a logical way.

One of the objections to dramatized fire prevention activities is that following such enterprises, an increase in the number of false alarms usually results. This is true, however, only when the campaign is a novelty; this element awakens in the minds of young persons and of adult inebriates a consciousness of the excitement connected with apparatus responding to an alarm. If, on the other hand, fire prevention activities are promoted continuously and are not sporadic campaigns, the logical conclusion is a marked reduction in the number of false alarms occurring over a period of a year. Beyond this, many competent authorities agree that a drive against false alarms can be just as effective as a drive for the prevention of fire, and that both can be carried on simultaneously.

We must not stand by idly while an undesirable situation continues to reduce the efficiency of our fire department operations. As a rule, the judiciary will be found to be coöperative. Parents called upon to pay a fine repeatedly will soon exert a proper parental influence on their children. The problem as a whole, however, should be solved before it becomes necessary to present cases in court, and this can be best accomplished by a sustained series of educational activities by the major fire departments over a period of time.

Boston is doing its share this year. At present, any system is necessarily one of trial and error, but by this process we may hope to arrive at a satisfactory and acceptable program. The false alarm problem is one which can be solved by sustained efforts. Nothing is accomplished by those who attempt nothing and in this case the desired end justifies repeated experimentation and deserves the best efforts of all.

Blocked Fire Doors.

By Robert S. Moulton,
Technical Secretary, N.F.P.A.

Directly opposite the office door of one of our leading fire protection engineer members of the N.F.P.A. is a stairway, properly enclosed with masonry walls and equipped with standard fire doors at every doorway to prevent the spread of possible fire or smoke up the stair shaft from floor to floor. A member of the N.F.P.A. staff, about to call on the engineer, observed the self-closing stair shaft door fastened open with a neat wooden wedge. The N.F.P.A. staff man walked up and down the stairway for several floors. Each door was similarly open, held with an identical wooden wedge. Doubtless the engineer member, who was in a position to do so, had arranged for suitable instructions to the building employees to keep the door closed. Doubtless the inspectors of the city fire department had given similar orders which were obeyed for a time after each inspection. Unquestionably the building code under which the structure was erected required the fire-resistive enclosing shaft with proper doors, and the building inspector had approved the plans on the basis of self-closing doors which would be closed at all times except when persons were passing through. Nevertheless the doors were all fastened open.

Based upon many years of experience in all sections of the United States, the writer has ventured the statement, with no dissent from any fire protection authority, that at least 90% of the buildings in the United States today are similarly deficient in the practical protection of vertical openings, either because the enclosure of openings is lacking or incomplete, or because some self-closing stair shaft doors are fastened open at least for part of the day. The only exceptions are where buildings are under unusually intelligent and efficient management, or are subject to very frequent, effective inspection backed by suitable authority.

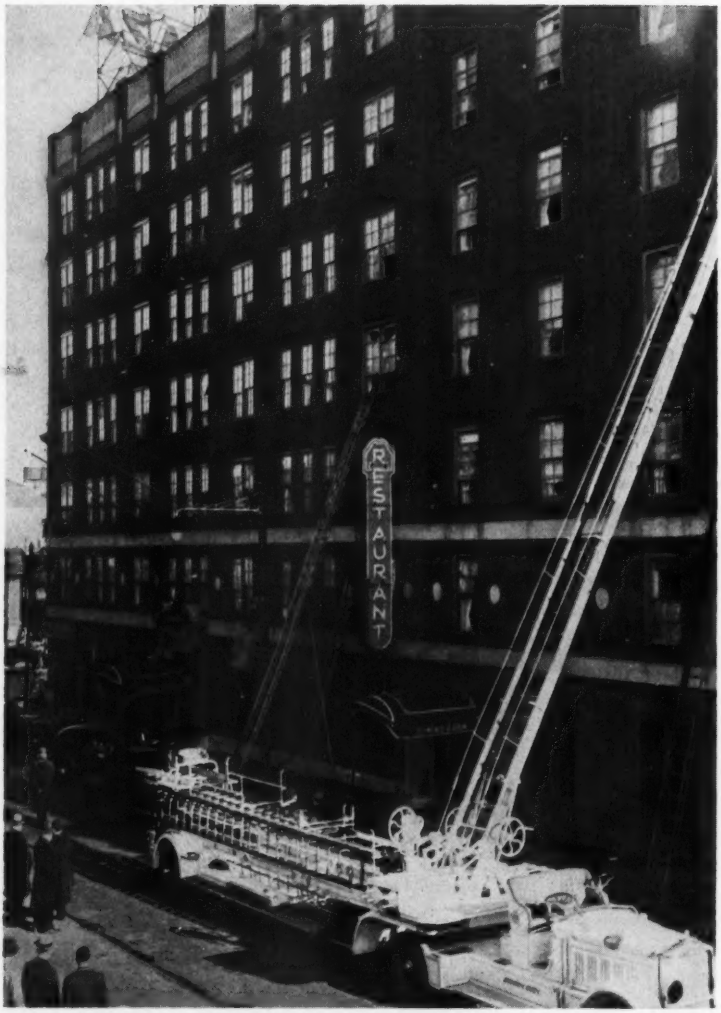
The fire protection fraternity has for many years agreed that protection of vertical openings is one of the most important factors in safeguarding life and property from loss by fire. Enormous effort has been expended in securing building code and other requirements on the subject. This effort has been remarkably successful in requiring or inducing property owners to spend many millions of dollars on the enclosure of vertical openings. But so long as the stairway doors are fastened open, this money has been largely wasted, and the expected benefit in reduced loss of life and property by fire has not been secured. This cannot be proved statistically, because along with the enclosure of vertical openings have come many other improvements in building construc-

tion and protection, and there is no way to allocate to each factor its proportionate share of reduced fire losses. All fire protection engineers should, however, agree to the major premise that the general practice of blocking open stair enclosure doors discounts to a large extent the value of this major factor in fire safety.

Why are the doors kept open? Fundamentally, because we have not yet educated the public to a proper understanding of the protection of vertical openings as a factor in fire safety. We have been content to get the doors installed, naïvely assuming after this major accomplishment, that the springs or weights provided for the purpose are all that is necessary to keep the doors shut. A self-closing door is not kept open through negligence, save in the rare case of failure of the closing mechanism. Some positive action must be taken, some device provided to keep it open. The reasons advanced for this practice are legion. Cleaning women carrying pails and mops are bothered by closed doors. Employees find the room stuffy unless the stair doors are open. Women and children may be injured by the swinging of heavy stairway doors during the noon rush. Sneak thieves may be more readily seen if the doors are open. The bottom of the stairway must be kept open to provide air supply for the boiler room in the basement. All compelling reasons to the building maintenance man. And all found in modern buildings under better than average management.

The conclusion seems inescapable that the money spent for the ordinary self-closing door is largely wasted, except where operating convenience requires that doors be kept closed, or the incentive to refrain from nullifying the self-closing feature is provided by a very exceptional management or by frequent inspection. The principal alternative, the automatic door, is now in the minority on stairway enclosures. In theory, the self-closing door is preferable because it is supposedly shut before fire reaches it, whereas the ordinary automatic door does not begin to close until there is sufficient heat to open a fusible link, and before closure is complete, smoke or possibly fire may spread up the stairway. There are special types of equipment to which these objections do not apply, but factors of expense, maintenance, etc., limit their general application to the average building. Another point is that automatic swinging doors, which are required on stairways instead of sliding or rolling doors for reasons of life safety, are commonly closed by an arrangement of weights, chains and pulleys which require more maintenance attention to keep them in operative condition.

There is available a combination device, worthy of more attention than it has heretofore received from the fire protection fraternity. This is a special type of door check or closer, which normally functions like any self-closing door mechanism, but which is so arranged that when desired it will hold the



A mid-morning fire in the lobby of this modern fire-resistive hotel took two lives on upper floors when smoke went up a stairway. Many others were endangered, but were rescued by the fire department or escaped down improvised ropes. There was no door at the bottom of the stairway in the lobby, and stair doors on upper floors had been fastened open to facilitate the work of hotel employees.

door open subject to closing by the melting of a fusible element in case of fire. This sort of arrangement seems to be a very practical solution, though some of the devices of this type are less rapid in operation than other types of automatic door closing.

An alternative used in a few schools and institutions is a self-closing door held open by a hook, with regular fire drills organized to close every door as a part of the fire drill procedure, or preferably with electrical connections to release all doors when the fire alarm is operated. The hooks used are also provided with a fusible link connection as an added safeguard, though the fusible link feature may not assure sufficiently rapid closing from the point of view of life safety. Expedients such as this are obviously not suitable for application to buildings of miscellaneous occupancies.

The ideal arrangement, of course, is the smokeproof tower, with access to the stairway by an outside balcony, so that the stairway will not become a flue even though the door to the balcony is kept open. But smokeproof towers, unfortunately, are not generally considered suitable for the uses of normal occupancy, and the building of smokeproof towers does not eliminate interior stairways.

It thus appears that there is no simple answer to this problem. Public education, more inspection, and more careful planning are all needed.

There is also needed much more attention to building code provisions on stairway enclosures, and their interpretation and enforcement, in order to control the lamentably common practice of doing lip service to fire safety by enclosing stairways on upper floors, but leaving them open on first floors, and in basements where the hazard is greatest. This is common practice, particularly in hotels and office buildings, in many large cities. In a middle western city the building code requires fire doors on stairway enclosures, but is vague about latches, so fire doors are commonly installed with no latches or fastenings to hold them shut. In a large eastern city the writer recently visited an office building, some years old, where substantial walls had been built around an originally open stairway, but no doors, nor even door frames, had been provided on the access openings. In a high class modern southern hotel he found an exit stairway, of standard appearance on the upper floors, which discharged not to the outside of the building, but into a basement garage with no cut-off. In a middle western metropolis, in a large building of modern construction, a stairway with an enclosure running upward from the fourth floor and all open below. And in the same building, an exit duly marked by a lighted exit sign, padlocked shut.

The fire protection man need have no immediate fear of working himself out of a job!

Flood Plain Zoning and Evacuation.

By H. C. Klein,
Chairman N.F.P.A. Committee on City Planning and Zoning.

Losses due to floods have been considerably augmented by fires which were caused by or which could not be readily extinguished because of flood conditions. It is also an established fact that following the recession of the flood waters, the peril of fire during the period of rehabilitation is greatly increased. For these reasons fire protection engineers and underwriters have become deeply interested in the flood control problem and its possible solutions. The purpose of this article is to point out how the conventional methods of flood control can be supplemented by city planning and zoning.*

City planning is the science of coördinating the physical elements of a community so as to attain unity and promote the general welfare. In many communities the existing arrangement of transportation and other essential facilities, as well as the uses of land, antedate any program of city planning as practiced today. The result was therefore one of uncontrolled development during a period when recent unprecedented flood stages were not believed possible. Each local Planning Board or Commission should be looked to as the coördinating agency best qualified to harmonize conflicts of interest and to replan flood-vulnerable lowland areas. The action of the Board would make such areas fit into the master plan of the community and thereby promote public safety and the general welfare.

There are many factors entering into the preparation of a master plan for any flood-vulnerable community. Such a plan should provide for the elevation of main avenues through inundated areas, thereby making possible ready access to these places and to near-by areas not flooded, but which would otherwise be inaccessible except by boat. Bridges should be designed to avoid possible delay in the operation of fireboats if such are available and bridge approaches should be an integral part of the elevated street system. It should provide for highways by-passing floodable areas, and the construction of railroad embankments with provision for emergency closure of underpasses and sewers so as to form flood walls. Public buildings should be located on sites of sufficient elevation to preclude all possibility of flood damage, or at the very least they should be located on sites from which public services can be rendered with a minimum of delay. For instance, fire stations should be situated where delays due to rerouting of apparatus responding to alarms can be avoided, and fire alarm headquarters where interruption of alarm service will be prevented.

*See "City Planning and Zoning in Relation to Fire Prevention and Fire Protection," published by N.F.P.A., 1934.

These means, as well as expensive levees, basins, etc., designed to prevent flood damages are excellent so far as they go. However, to still further reduce flood damage, new methods must supplement the old; methods based upon the less expensive and common sense procedure of keeping people and personal property out of the paths of floods. This procedure is of course a complete reversal of the present one of trying to keep floods out of the paths of population and away from personal property.

It has been characteristic of our civilization to take advantage of every opportunity to exploit natural resources so as to derive the maximum profit and enjoyment from existing facilities with comparatively little thought for the future. As a consequence there has been much ill-advised occupancy and use of land along the banks of our rivers which has contributed to the loss of life, health and property and to the cost of relief and public works. By building homes, stores, warehouses and factories along river banks and in the low-lying areas adjacent to our rivers, we are exposing more and more life and property to the ravages of floods. We have encroached upon the natural channels of our rivers, the erection of each structure adding to the resistance to the flood flow, thus increasing the flood stage and likewise the resulting damage. Thus we see vast amounts of public funds being expended to provide protection in the form of barriers, etc. Unfortunately, such protection, essential though it may have become, is likely to create a false sense of security, which may result in further encroachment upon flood-vulnerable areas, followed by the need for more and more barriers, etc.

In an editorial which appeared in its issue of March 11, 1937, the *Engineering News-Record* said:

> Traveling down the Ohio during the recent flood one could notice scores of farm-homes completely inundated, though standing only a stone's throw from high ground. Villages were flooded, while a few hundred yards away dry land rose above the muddy waters. Is it sound economics to let such property be damaged year after year, to rescue and take care of the occupants, to spend millions for their "local protection," when a slight shift of location would assure safety? Is it right that the country as a whole should pay for local protection of such vulnerable spots as Wheeling Island, where 10,000 people insist on occupying a low-lying island that is hardly more than awash at low water? Is it right to perpetuate decrepit slum districts in the flood zones of the larger river-bank cities, peopled by masses that become refugees and relief cases at every high water? Portsmouth has answered this question by declaring its intention to convert its low-lying sections into a park.
>
> The Federal government has never seen fit to establish flood flow boundaries for its rivers, though in the interest of navigation it has assumed the right to mark low-water channels. Pierhead and bulkhead lines are laid out in every harbor, and navigation clearances are set up on which no encroachment may be made. Yet people and industries have been permitted to occupy normal flood channels, and flowageways have been restricted by filling in and by commercial development without federal protest. It may not be possible at this late date to restore the flood ways to the rivers completely. Occupation and development of the flood plains have proceeded so far that we are now forced to spend huge sums to control floods. Plans for reservoirs and floodwalls are commendable; their cost, stagger-

Pictures, Inc.

Fires increase the horror and damage of floods, while fire fighting facilities are largely ineffective. (This picture was taken during the 1937 floods on the Ohio River. See Quarterly April, 1937, page 322.)

ing though it may be, is less than the loss caused by one big flood. Yet in planning flood relief let us remember that the river has rights, and these rights must be respected.

Had our ancestors foreseen what we have experienced in recent disastrous floods and had they adopted "flood plain zoning," our generation would have a far less serious flood problem to solve. To the extent that we learn from their lack of foresight and adopt zoning as a modern method of preventing flood damage, will we earn the gratitude of those who follow us.

What is "flood plain zoning"? It is a comparatively new development in city planning and zoning. Zoning, a branch of city planning, is the subdivision of a community into districts in which regulations differing by districts control the uses of structures and the use of land. It is accomplished under the police power of government and is purely regulatory. Planning, on the other hand, may be accomplished either by police power or by right of eminent domain. "Flood plain zoning" is therefore the subdivision of areas of a community which are subject to periodic flooding into districts where differing regulations, controlling structures and the use of land apply in accordance with the extent and frequency of coverage by flood waters. For example, "flood plain zoning" would prohibit all uses of land in certain districts subject to frequent and extensive flooding, except agriculture, orcharding, dairying, automobile parking or recreation, while in other districts not so frequently or extensively flooded, certain commercial and heavy industrial uses, subject to comparatively little damage by flood waters, would be permitted. In the latter case the zoning might be supplemented under building codes by requiring construction designed to resist flood damage. In some localities "flood plain zoning" would prohibit especially dangerous types of land use such as tanks for the storage of flammable liquids.

The prevention of the use of flood-vulnerable land for residential or other unsuitable purposes can be effected by two methods: (1) by "flood plain zoning" against such occupancy at the time communities adopt zoning ordinances, or when they amend existing zoning ordinances, and (2) by refusal of local planning boards or commissions to approve land subdivision plats which are subject to flooding. City planning and zoning is done under state enabling laws enacted for the promotion and conservation of public health, safety, morals, and general welfare.

Although the New York State Enabling Act was no exception, the 1938 legislature of New York amended the State Planning Enabling Law to take into consideration whether the land to be platted is "of such a character that it can be used safely for building purposes without danger to health or peril from fire, flood, or other menace." While such reference to the peril of flood will definitely fortify New York planning boards to reject flood-vulnerable plats, and while it would be advisable for other states to similarly amend their enabling acts, it is believed that planning boards and commissions in other states have ample authority now to reject such plats. For example, the Massa-

chusetts Planning Enabling Act provides "that the land shown on such plat shall be of such character that it can be used for building purposes without danger to health." Under the Kentucky Enabling Act every Planning Commission "shall prepare regulations governing the use of land within its jurisdiction" in relation to the Master Plan which "shall be made with the general purpose of guiding and accomplishing a coördinated, adjusted and harmonious development of the municipality and its environs which will, in accordance with present and future needs, best promote health, safety, morals, order, convenience, prosperity and general welfare, as well as... the promotion of safety from fires and other dangers."...The Indiana City Planning Enabling Act authorizes Planning Commissions to regulate subdivisions of land so as to "provide for a distribution of population which will tend to create conditions favorable to health, safety, convenience, or prosperity." Statutes of New Jersey (Laws of 1929, Chap. 267, Sec. 11), Washington (Laws of 1935, Chap. 159, page 505) and Wisconsin (Laws of 1935, Chap. 303, page 443, Sec. 1) designed to establish lines against encroachments upon stream channels and to license erection of new structures in flood plain areas, might also be used to prevent unsuitable land uses in such areas.

Manifestly the flooding of residential and business structures by river waters laden with débris, filth and pollution is dangerous to health. When such waters are covered with flammable liquids released from damaged storage tanks and conflagrations result, such as the Mill Creek conflagration at Cincinnati during the 1937 flood, and when fire departments are incapacitated, and electrical wiring rendered hazardous by submergence in flood waters, there is ample evidence that the fire peril to property and to life is also a serious accompaniment of floods. If any other consequences of floods were necessary to justify the exercise of the police power in "flood plain zoning," there are the efforts and expense of emergency evacuation and relief work, rehabilitation, and the increasingly greater and more expensive physical flood control projects which will be necessary if increases in the occupancy of periodically flooded areas are not curtailed.

On February 10, 1937, the City Council of Cincinnati, Ohio, adopted an emergency ordinance "to prohibit for the period of six months, the issuing of permits in flood districts for new dwellings or for the reconstruction or structural alteration of old dwellings damaged to the extent of 75% or more." The ordinance stated that its purpose was to prohibit the premature reconstruction of dwellings in flood areas during the period of time while the Council would have under consideration proposals to rezone the affected areas. On June 9, 1937, the ordinance was repealed because a majority of the members of the Council felt that it worked an unnecessary hardship upon citizens financially able to repair their damaged homes. Meanwhile a public hearing was held on the proposed amendment to the Municipal Zoning Code whereby

dwelling structures were to be prohibited in certain industrial use districts which are also periodically flooded. Because of considerable opposition, action on the amendment was indefinitely postponed.

In Louisville, Kentucky, immediately following the 1937 flood the Planning and Zoning Commission recommended to the Board of Aldermen that the zoning ordinance be amended by creating a new industrial use district embracing the periodically flooded sections within which no new residential structures could be erected or existing residential structures altered. Due to considerable opposition from the residents who wished to reoccupy their homes, and since the city had insufficient funds to purchase all of the properties affected, the Board refused to pass the amendment. Fortunately funds, largely provided by private subscriptions, subsequently enabled the city to purchase much of the areas which were included in the proposed amendment and to set them aside as a park.

As both the proposed Cincinnati and Louisville Zoning Code amendments sought to accomplish the prevention of future residential use of certain low-lying areas because the areas were industrial districts, it is of interest to note that this expedient was proposed in Cincinnati because the Council preferred to exclude dwellings from certain use districts rather than from an area below a certain elevation, and in Louisville because the expedient would permit the existing industries to continue.

Of significance in this connection is the following statement in the "Special Report of the Massachusetts State Planning Board recommending Ratification of certain compacts with other New England States for flood control in the valleys of the Connecticut and Merrimack Rivers" submitted to the Massachusetts State Legislature in April, 1937.

> It is also the opinion of the State Planning Board that considerable personal distress might be eliminated in the future by the adoption of careful, comprehensive and conservative zoning plans covering those areas adjacent to the Connecticut River and its tributaries. The statement has been made that if the areas along the Ohio River had been zoned for recreational, shipping and industrial uses, and no residences allowed, the appeal for aid for flood victims would have been greatly minimized.

Flood Plain Zoning is merely a new application of the principles of zoning which have been applied in several other fields. Reforestation by regulation of private uses of forest land differing by districts, is zoning. So is the regulation of the uses of sub-marginal farming lands, and the regulation of the rehabilitation of land which has been eroded by water and wind, when such regulations differ by districts. As the Pennsylvania State Planning Board stated in its Monthly Bulletin of September, 1937:

> Whether we spend our money for safety by flood control projects or for the zoning and resettlement of endangered inhabitants or for flood damage and devastation, the flood plain takes its toll. The problem of social planning is to determine what combination of remedies is the better investment of the taxpayers' money. It is of considerable importance that the analogy between flood control, erosion control, submarginal cut-over or abandoned

American Red Cross.

Airplane view of old Leavenworth during the height of the 1937 flood.

farm land and all land-use rendered unsuitable by its locale or application should be fully grasped.

Flood Plain Evacuation.

Flood Plain Zoning alone will obviously not keep people out of the paths of floods. It will prevent future residential occupation of flood paths, but it cannot remove people now living there from continuing to occupy and reoccupy the existing homes which will be periodically flooded, flood control works to the contrary notwithstanding. Such removal must be accomplished by "flood plain evacuation" which involves the acquisition by the government of affected lands and structures by condemnation, or purchase under the power of eminent domain. Quoting again from the Pennsylvania State Planning Board's Bulletin:

> In dealing with flood hazards—as with drought and erosion—we have so ardently exerted ourselves as to the means of abating the physical aspects of the hazards that we have neglected to canvass the possibilities of removing endangered inhabitants. This defect is all the more unfortunate inasmuch as the expenditure of millions for flood control works not only cannot assure positive security against all possible flood damage but could effect, if applied to the resettlement of the inhabitants of flood endangered areas and the public acquisition of lands restricted to recreation and other suitable public uses, a larger return in safety and peace of mind at perhaps a smaller cost.

Although Flood Plain Evacuation can be accomplished under the power of eminent domain, there are several notable examples of such evacuation which have been the result of the expressed will of the local population; for instance, the removal of the complete municipalities of Leavenworth, Indiana, and Shawneetown, Illinois, to flood-safe town sites. Leavenworth was a town of 418 population, situated at an abrupt turn on the Ohio River. During the 1937 flood, water first entered the town on January 21 and remained until February 5, attaining an average maximum height of 25 feet above ground level and inundating practically 90% of the town. After the flood, 45 buildings were

American Red Cross.

This view of the former site of Leavenworth, Indiana, illustrates the exposed position of many river-bank communities.

missing, 20 had collapsed and many others had been moved from their foundations.

A new town site on a high bluff back of the river was laid out by the State Planning Board following a petition to the Governor in which, by a vote of 167 to 11, the citizens expressed their desire to move the town to higher ground, and petitioned the State Highway Department for the relocation of the state highway through the new town site. With the American Red Cross coöperating, and aided by a loan of $25,000 from the Disaster Loan Corporation (a subsidiary of the R. F. C.) to be amortized by income from the new water works, the W.P.A. started work on August 15, 1937. On December 15, 1938, the new town was dedicated. All Red Cross relief costs approximated $100,000, of which $25,000 is chargeable to prevention, since it represents the difference in cost between rebuilding on the old and new sites. Based on the flood history of Leavenworth, this prevention cost will be saved many times in years to come.

Shawneetown, Illinois, was a city of 1500 population on the Ohio River, which overflowed the levee on Jan. 21, 1937, inundating the entire town to an average depth of 28 feet, and did not completely recede until March 12. Approximately 200 buildings were destroyed and 150 damaged. As a result of conferences between Federal agencies, the Illinois State Housing Board, the American Red Cross, local officials and civic organizations, it was deemed more desirable to remove the entire city to an area on higher land three miles back from the river than to attempt to rehabilitate the existing site. A local county housing authority was created which obtained a loan of $350,000 from the Disaster Loan Corporation. The housing authority holds title to all land on the new site, with the exception of portions to be devoted to public uses, and is removing and rehabilitating partially damaged houses and constructing a suffi-

cient number of new houses to provide for the remaining population. The State will purchase the entire old town site for a State Park, in which buildings of historic value will remain. The W.P.A. is constructing necessary streets, public utilities and public buildings on the new town site, which is expected to be completed and dedicated within 18 months from October, 1938, when work on the project began.

Obviously the difficulties attending "flood plain evacuation" are greater than those of "flood plain zoning." The expense of evacuation is greater since compensation for land taken will, in most instances, be based on the value of developed land and existing structures, whereas "flood plain zoning" will in most cases involve only unimproved land. Opposition from owners of improved land to be evacuated will be greater than that from owners of land to be zoned against future building construction. Great rivers fascinate those who were born and reared along their banks and who love the rivers in all their moods. People in their situations have learned to expect periodic eviction from their homes by flood waters, nevertheless, they honestly testify that they would not live elsewhere. They grumble when floods cause them to move out and clean up before they can move back. But they stoutly maintain that should their residences be a total loss, they would nevertheless rebuild on the same site. Strong opposition to being permanently evicted from their flood-vulnerable home sites is therefore to be expected from such folk. The weakness of such opposition, however, is in the fact that floods are catastrophes with community wide effects and that even in a democracy rugged individualists cannot be permitted to jeopardize public health, safety, and general welfare and to periodically put the community as a whole, and various relief agencies, to the expense and anxiety associated with emergencies created by floods.

Economics of Flood Plain Zoning.

What of the economics of "flood plain zoning and evacuation"? To the average land owner the best use to which to put his land is that use which yields the most profitable return. As the best uses for land from the viewpoint of the community also involve economic considerations, physical planning must take into account economic as well as social, technical and engineering factors. Long range planning of all flood-vulnerable areas against occupancies unsuitable and injurious to the occupants and to the community as a whole, is unquestionably a highly desirable social objective, but will economic considerations always permit? If economic considerations would always permit, the ideal situation would be to have all areas subject to flood utilized as recreation centers or parkways which would enhance the beauty of the city and contribute materially to the welfare of its citizens during normal periods and which would suffer the minimum of loss during periods of inundation.

In the view of the Massachusetts State Planning Board as expressed in its "Blackstone River Drainage Basis Study No. 1," speaking of certain recom-

mended channel improvements: "Flood control is a business proposition and the cost of preventing damage must not exceed the damage itself averaged over a period of years and capitalized." But by what formula shall the relationship of cost to damage be determined? What factors shall be taken into account? Few types of engineering present so many variable factors as flood control in all its aspects. No engineer can predict definitely how great a flood may occur at a given location. The best that can be said after studying the incomplete data available is that no river has yet produced its greatest flood. Whatever may be the measures of flood control under consideration in a given case, a large margin of safety must be applied because lives as well as property values are at stake. Although injury and death to persons can be roughly reduced to economic costs, taking age, economic status, and dependents into consideration, nevertheless the value of life is literally incalculable and flood damage prevention involves far more than merely the economics of property values.

In the view of Congress expressed in the Flood Contract Act approved June 28, 1938:

> In any case where the construction cost of levees or flood walls included in any authorized project can be substantially reduced by the evacuation of a portion or all of the area proposed to be protected and by the elimination of that portion or all of the area from the protection to be afforded by the project, the Chief of Engineers (of the War Department) may modify the plan of said project so as to eliminate said portion or all of the area: Provided, That a sum not substantially exceeding the amount thus saved in construction cost may be expended by the Chief of Engineers, or in his discretion may be transferred to any other appropriate Federal agency for expenditure, toward the evacuation of the locality eliminated from protection and the rehabilitation of the persons so evacuated.

Under this authority the War Department has made several studies and concluded that the cost of evacuation would greatly exceed the cost of providing protection for Uniontown, Kentucky, and that neither evacuation nor levee protection for a particular area at Wellsville, Ohio, could be justified economically. A study at Point Pleasant, West Virginia, is now in process.

Quoting from "Drainage Basin Problems and Programs—1937 Revision," a report transmitted to President Roosevelt on February 4, 1938, by the National Resources Committee:

> Appropriate Federal, State, and local action looking toward the zoning of the flood plains of the rivers under discussion against undesirable and dangerous use is urgently needed. For many small communities the cost of local protection would be far greater than the cost of their relocation. It is clear that social controls in the occupation and utilization of the flood plains of these rivers, especially in urbanized areas, may contribute much to a solution of the problem of their floods.

Where flood plain zoning or evacuation is in question, by what standard or formula shall the necessity for, and the extent of, such zoning or evacuation of a given area be determined? In view of its large investment of funds in housing projects, the United States Housing Authority was addressed requesting information respecting the standard of the Authority where projects on lands subject to flooding are under consideration. In response, the Housing

American Red Cross.

This view of Leavenworth from the old site shows some of the buildings of the new location on the bluff above.

Administrator, Mr. Nathan Straus, wrote as follows on Feb. 4, 1939:

It is our policy, in general, not to approve sites for housing developments which are subject to flooding. Quite definitely we will not approve sites which are subject to frequent or periodic flooding. Where the possibility of flooding may be considered only very remote, we then study fully the extent of the danger and make our decision on the basis of all circumstances affecting the site. In no case would we be willing to approve a site where there might be even a remote possibility of a flood which would have disaster characteristics. For example, if a site were proposed which is protected by a levee which our engineers might not consider adequate, as to height or as to construction, to protect the site against the highest flood which might be considered possible, and if the failure of such levee to protect would endanger the site to flooding to a disastrous depth or with a dangerous current, we would certainly not approve the project. If, on the other hand, a site were proposed which is protected by a levee which is ample for all but the most unusual floods; if the record should indicate that such floods are not to be expected except, perhaps, at exceedingly long intervals; if provisions have been made for preventing any serious consequences as a result of such unusual floods (such, for example, as the opening of sluiceways in a manner to cause a gradual and not too deep submergence without much current); and if the materials of construction of the project should be such that a moderate and gradual flooding would not be particularly injurious; then, under such conditions, we might be willing to at least give consideration to the selection of the site proposed. Even so, however, we would wish to be convinced that another acceptable site free from any remote possibility of flood is not available.

In studying such a situation, we would take into account also any plans for future flood protection for which there might be a reasonable chance of consummation. In other words, in the case of a very remote possibility of flooding, we would be inclined to weigh very carefully all of the probabilities before definitely accepting or turning down a site proposed to us by a local housing authority as being its choice in view of all other circumstances. But in no case will we accept a site subject to periodic flooding. Even where a site may be protected by a levee from direct flooding, it is necessary for us to consider also the danger of the interruption of utility services, sanitary sewage disposal, etc., which may be caused by high water.

The evaluation of the probabilities of flooding, where only the highest flood stages are to be considered, is very difficult and certainly cannot be placed upon an actuarial basis. Experienced engineers are aware of the possibility and of the occurrence in frequent cases of floods which overtop all previous records, even after a most careful search for the previous high water-mark has been made. The elimination of all areas which may be subject to such unprecedented floods would remove from residential use large portions of many populous cities. The question of flood plain zoning resolves itself, therefore, into a question of the degree of risk which may be accepted.

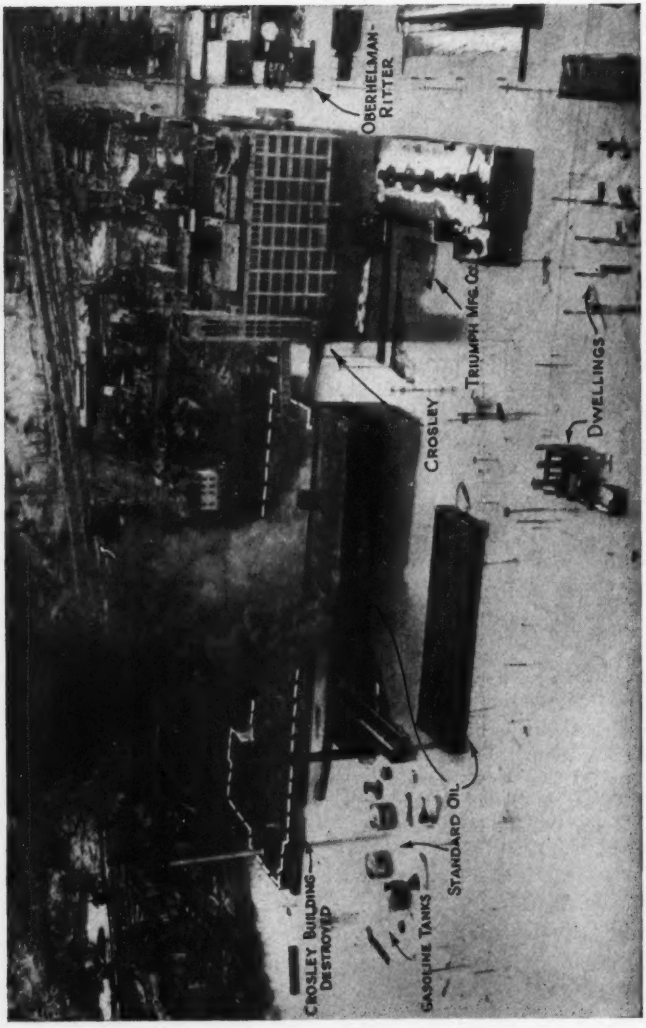
As an example of how untrustworthy flood data can be, a Louisville, Kentucky, housing project which was never flooded prior to the time construction began, was flooded in January, 1937.

Inevitable is the question, "What will be the attitude of the Courts where a property owner seeks legally to resist "flood plain zoning or evacuation?" Should a test case arise, it is to be hoped that it will present a clear-cut situation definitely involving public health, safety, and general welfare, including the element of economic waste viewed from the community, as well as from the complainant's standpoint, and where also adequate records and engineering testimony is available, clearly justifying the exclusion of injurious and unsuitable land uses from the area involved. In such a case, even though the complaining property owner shows economic loss, the Court may be expected to sustain the defendant municipality or planning commission as having soundly and properly exercised the police power in the interest of general welfare.

In so doing the Court will find ample support in the famous and fundamental case of the village of Euclid, Ohio, vs. Ambler Realty Company (272 U. S. 365), in which the United States Supreme Court upheld the exclusion of business from a residential zone created by the Zoning Ordinance, notwithstanding the appellee alleged that the enforcement of the Ordinance greatly reduced the value of its lands and destroyed their marketability. The Court said:

> If these reasons, thus summarized, do not demonstrate the wisdom or sound policy in all respects of those restrictions which we have indicated as pertinent to the inquiry, at least, the reasons are sufficiently cogent to preclude us from saying, as it must be said before the Ordinance can be declared unconstitutional, that such provisions are clearly arbitrary and unreasonable, having no substantial relations to the public health, safety, morals or general welfare.

Of particular interest in connection with this consideration of the economics of "flood plain evacuation" is the recommendation of the Cincinnati City Planning Commission contained in its report of December 31, 1937, on "The Cincinnati Waterfront, Its Problems and Recommended Future Utilization," respecting the suburb known as "California," situated on the flood plain of the Ohio River. The Commission pointed out that one roadway, which is flooded by a river stage of 55 feet, is the only connection between this community of 806 persons and Cincinnati proper, and could be closed in so far as the city is concerned. It further pointed out that 80% of the homes of the commu-



The 1937 flood damage in Cincinnati was greatly increased by fire. This picture shows the result of fire due to gasoline released on the flood waters.

nity are flooded by stages of from 56 to 60 feet, that the entire community is flooded out by an 80-foot stage, that it is sewerless and undeveloped, that it has an assessed valuation of only $466,760 and that its only school has been recommended for abandonment.

Exclusive of the cost of constructing a levee around the suburb, which would be the first necessity, the cost of installing sewer and drainage systems with pumping facilities adequate to discharge into the river at high stages, would equal the total assessed value of the property to be protected. As the community could not stand a reasonable assessment, nor would be likely to ever develop into a high type of community, being twenty-five feet below the levee, the Commission recommended that the entire suburb be evacuated, the city to purchase the land and buildings and convert the site to some public use, preferably a park.

To quote from "A Common Sense View of the Flood Problem," by Wayne D. Heydecker, Director of the Division of State Planning, New York, and Edwin S. Cullings, Water Resources Consultant (constituting Bulletin No. 28 of the Division):

In considering the removal of residential property from the flood zone, a direct comparison of the cost of a proposed flood control project with the value of the property to be abandoned does not tell the whole story. Many flood control improvements furnish partial, rather than complete protection and extreme floods may still cause damage, even after control works have been built. On the other hand, if a move from the flood plain to a safe elevation is made, complete protection against all possible floods can be secured, once and for all, as easily as partial protection. Such a move need not be made all at once, but over a period of years as the structures become depreciated and obsolete. Some of the buildings in these waterfront districts are no more valuable than those which other cities are tearing down and rebuilding as part of their slum clearance schemes. Many of these buildings will be abandoned for other reasons than floods within the next 20 to 30 years, and, if at such times they are replaced on a new and safer site, the cost of the change will not be great. The new development on higher ground, through modern town planning for twentieth century conditions, may so far exceed the efficiency of some of these districts as to justify most of the cost of the change, leaving the amount fairly chargeable to flood avoidance considerably less than the cost of protective works. In the opinion of the Division of State Planning the time has come for the formation of a definite policy toward flood control by the state and its municipalities. The Division of State Planning of New York, therefore, offers the following, in the hope that it may serve as a guide to the formulation of definite municipal plans.

A Program of Practical Steps for the Ultimate Evacuation of the Flood Plains.

It is suggested:

1. That the appropriate officer or governing body in each community so situated as to be subject to serious flood hazard determine, in so far as possible, the area subject to flood damage and clearly inform the citizens of the community of the limits of such flood district.

2. That each river community, by action of its governing body, amend its zoning and building codes in such manner as to prevent the construction of new dwellings in the potential flood district, and to limit commercial and industrial structures in accordance with the

hazard involved, in much the same manner as fire zones are now established. That each municipality under the police power, be authorized to require the gradual removal or modification of obstructions in stream channels and the removal of such hazardous structures as oil tanks which may break loose and add to the flood danger the further danger of fire.

3. If it has not already done so, that the governing body of each river community create a planning board or commission and appropriate sufficient funds for the preparation of a comprehensive city, village, or town master plan, including a program for the development of suitable building sites on higher, safer land, with necessary public facilities, such as streets, sewers, water mains and schools, for the people now occupying land within the flood zone, to the end that as such facilities are provided there may be a gradual voluntary removal of persons and vulnerable properties out of the danger zone.

4. That the governing body of each such river community establish in some appropriate municipal office a committee or agency to coöperate with the residents of the flood zone and with the Federal Reconstruction Finance Corporation in financing the movement of individuals and industries from such flood districts to higher and safer land.

5. That such planning board or commission also work out a plan and program for the ultimate public acquisition of the land in such designated flood district for waterfront parks or other suitable public uses or alternatively to develop a plan by which such land may remain in private ownership for such uses as may not be incompatible with adequate flood protection.*

6. Such part of the cost of flood control works, such as retarding basins, regulating reservoirs, dikes, levees, walls, etc., as may be allocated to the local community should be borne primarily by the property protected by such improvements rather than by the community as a whole. Our present procedure under the river regulating district law permits the apportionment of the cost upon the properties benefited, but in practice the assessments against a municipality are made a city or village charge and so fall upon the prudent home owner, who has built upon the hill, as well as upon the owner of the property subject to damage. In effect we now subsidize the continued occupancy of the flood plain by charging the cost of protection against all the people, through general taxes.

Here indeed is a common sense and realistic program which should appeal to all officials of river communities subject to periodic floods, to city planners, and to fire prevention and protection engineers. To all of them the flood problem presents a challenge and opportunities to coördinate their efforts to effect a solution in the interest of public safety and general welfare. No other known methods of preventing flood damages offer a basis for their coöperation so constructive and full of potentialities as "flood plain zoning" and "flood plain evacuation."

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*AUTHOR'S NOTE. As this program was proposed in May, 1937, it does not advise making use of the authority definitely conferred on Planning Boards by the 1938 New York Legislature, to take into consideration whether land submitted for approval for subdivision plats is "of such a character that it can be used safely for building purposes without...peril from fire or flood." As the amendment conferring that authority was sponsored by Mr. Heydecker and the New York State Federation of Official Planning Boards, the rejection by planning boards of flood-vulnerable lands for subdivision and development should now be considered a part of the New York program. Municipalities in other states should not hesitate to reject floodable subdivision plats because their planning laws do not specifically mention the flood peril. As has been pointed out, the police power reasonably exercised in the interest of public safety and general welfare constitutes sufficient authority for such rejection.

Fire Tests of Wood Doors.

The performance of various types and patterns of doors in fire exposure tests has often been demonstrated at Underwriters' Laboratories, Inc., and other testing stations. In nearly all cases, however, the test specimens have been newly manufactured and designed with test conditions in mind.

Underwriters' Laboratories, Inc., have recently reported a series of fire exposure tests on a variety of ordinary wood doors and on several old "fireproofed" wood doors; the latter having been secured from a 25-year-old New York hotel which was being demolished. The tests were the standard exposure tests of Underwriters' Laboratories, Inc., for fire doors, except that the fire stream was not subsequently applied, and offer an opportunity to compare the fire-resistive properties of 25-year-old treated doors with untreated doors of recent manufacture.

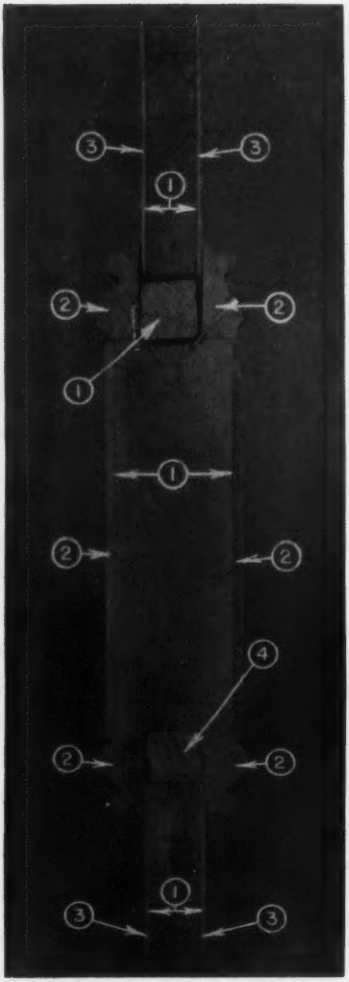
Tests of Old "Fireproofed" Doors.

The old "fireproofed" doors were of the paneled type and were constructed of white pine with a hardwood veneer. These doors were hung in a panel furnace in accordance with standard test procedure and exposed to fire controlled in accordance with the standard time temperature curve. The temperature of the furnace reached a maximum of 1450° F. after 20 minutes, when the tests were terminated.

After periods of exposure varying from 15 to 18½ minutes the panels in the doors buckled and fell from position. No passage of flame through or around the doors nor of hot gases or smoke occurred in significant amount until the panels began to buckle and fall out of their grooves. There was general and progressive buckling and sagging of the panels during the later periods of the tests, yet all rails and stiles remained in position. It was observed that although the failure of the panels was mechanical, since they fell out only after the exposed panel mouldings were consumed, they would probably have burned through long before the one hour period for which labeled fire doors are tested.

In addition to the fire exposure tests, samples from one of the doors were subjected to the Dunlap Fire Tube test and the Crib test, the results indicating the specimens were "fireproofed" and that the treatment retained a substantial proportion of its effectiveness more than 25 years after application. The water extract from this treated wood was found to contain large amounts

NOTE: This article has been abstracted from Underwriters' Laboratories, Inc., Bulletin of Research, No. 5, Fire Exposure Tests of Old Fireproofed Wood Doors, and No. 6, Fire Exposure Tests of Ordinary Wood Doors.



General appearance of a typical section through one of the old "fireproofed" doors before the test. The kinds of lumber used are identified by numbers on the photo referring to the list below.

1, white pine; 2, birch; 3, crossbands, yellow poplar; faces, birch; 4, hickory.

of ammonium sulphate and ammonium phosphate and small amounts of iron and sodium salts.

Tests of Untreated Wood Doors.

Three untreated wood doors, newly manufactured, were purchased in the open market and after receiving a varnish finish over oil stain were subjected to the standard fire exposure test. These doors represented the two types, the paneled and the flush type. Two doors of the former style were tested, one having a large single panel; the other two smaller panels. These doors were also hung in a panel furnace in accordance with standard procedure.

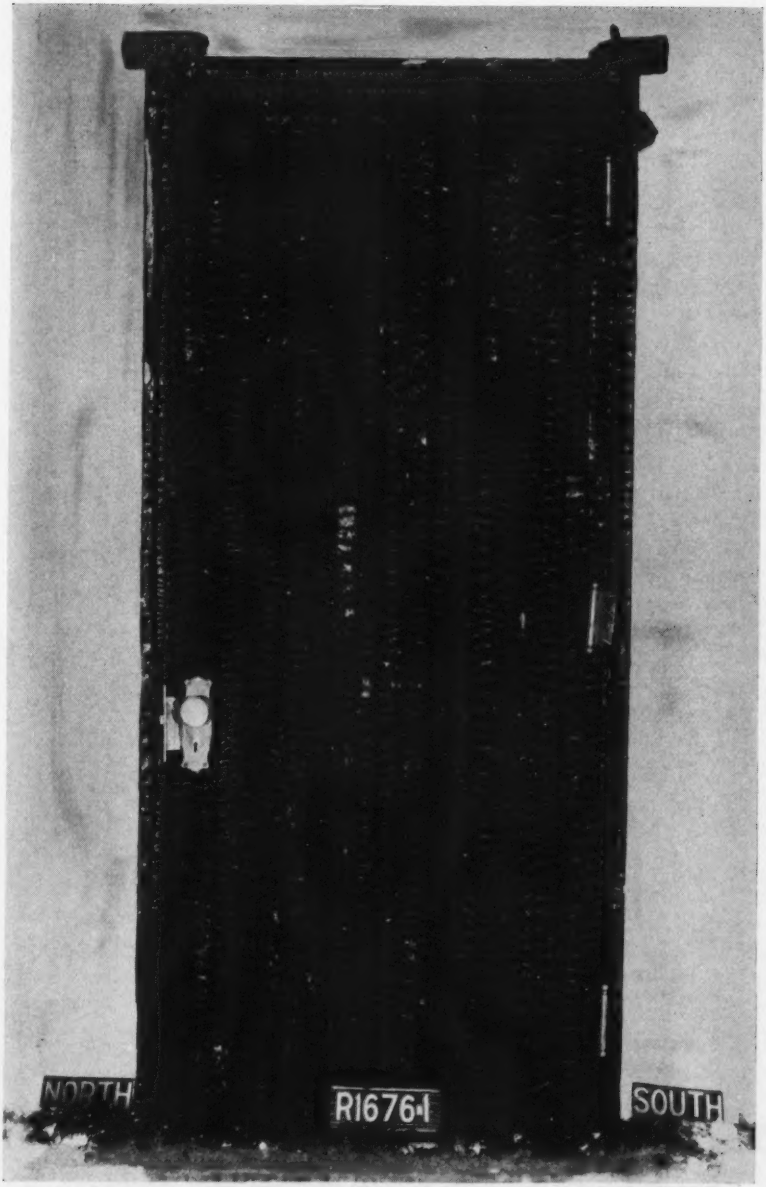
The flush type door consisted of a soft wood glued-up core 1½ in. thick covered on each face with a crossbanding of gum veneer and an outer finish veneer of oak. After installation in the panel furnace, it was found that the door was warped so that one upper corner was ⅜ in. away from contact with the stops on the frame.

Twenty seconds after the test began, smoke was observed passing over the top of the door, and after 8½ minutes, flame also. The door bulged rather smoothly toward the fire. Combustion of the door was most rapid at the upper and lower edges and in the immediate neighborhood of the lock, but a considerable portion of the door structure was consumed by progressive combustion extending inward from the entire fire side. At 24 minutes the door fell into the furnace, the wood around the lock and hinges being charred or consumed so that the screws no longer held, whereupon the test was stopped.

Unexposed side of old "fireproofed" doors after about 14 minutes of exposure, showing one panel fallen from place, the ignition of the panel finish and the general buckling of the other panels.

The principal difference between the single and two-panel type door was in the thickness of the panels, the former having a 5-ply panel measuring ¾ in. in thickness, the latter having two 3-ply panels each 5/16 in. thick. The stiles

Unexposed side of new 5-ply panel door after test. The flames were retarded by this door 3 minutes longer than by the two-panel type.



Exposed side of new flush type door after test. This door fell into the furnace after 24 minutes when the hinge screws and lock would no longer hold in the charred wood.

Exposed side of old "fireproofed" door after test. Eighteen and one-half minutes of exposure was sufficient to cause the two upper panels to fall from position. Brick furnace wall visible through spaces originally occupied by panels.

and rails of both doors finished 1¾ in. thick, consisting of ⅛ in. veneer over a white pine core.

When subjected to the fire test, the panel of the single-panel door bulged away from the fire after seven minutes of exposure. In 30 seconds more, flames were issuing from cracks at the edges of the panel. At 8½ minutes a hole at least 1 ft. square had been burned through and after another minute portions of the panel were falling away. After 10 minutes the fire was extinguished.

The two-panel door did not stand up against the fire as well as the door in the test just described. Passage of smoke began at the upper edge of the door after 45 seconds and after 4¾ minutes flames issued through the center of the lower panel, which was rapidly consumed. Ten seconds later similar sudden failure of the upper panel occurred.

These tests have proved that the fire retardant property of ordinary wood doors is proportional to the thickness thereof. Other important factors, however, are the clearance between the door and the frame, the effects of warping, the type of hardware and the method of attachment. It was also shown that in paneled doors the method of attaching the panel to the rails and stiles is of importance. Stresses may cause a poorly secured panel to spring out of place before it is burned through.

In their report Underwriters' Laboratories, Inc., says, "The results of these three tests show that neither the flush nor the paneled doors constructed of ordinary wood, of the types, designs and materials described, should be recognized for use where fire retarding is a necessary performance characteristic. The doors are made entirely of combustible material, ignite easily, and are markedly inferior in fire exposure resistance to doors of the types listed as 'fire doors' by Underwriters' Laboratories, Inc."

Comparison of Results.

The "fireproofed" and ordinary wood doors were of different construction, so the fire test results are not directly comparable, but the results indicate a substantially greater fire resistance for the "fireproofed" doors. Failures of the ordinary doors of panel type occurred in less than nine minutes, while the "fireproofed" doors withstood the test fire about twice that period. However, in neither case is the degree of fire resistance sufficient to warrant consideration for use in situations which call for a material degree of fire resistance, and where standard fire doors are commonly specified. From a life safety point of view wooden doors may be of material value in retarding the spread of fire for a period sufficient to permit raising fire department ladders or escape from the fire by some other means, particularly in residential occupancies, where the initial intensity of fire may perhaps be less than that of the standard time temperature curve. These tests, however, indicate the danger of relying on anything less than standard fire door installations for any substantial degree of protection.

Treatment of Burns With Aniline Dyes.

By Robert Henry Aldrich, M.D.,
Visiting and Asst. Surgeon, Carney Hospital, Boston City Hospital, and
Harvard Medical School, Boston, Mass.

The toxemia of a burned patient is due to an invasion of the body through the burned area of violent forms of streptococcus, and is not due to the absorption of a burned protein nor to a shifting of the water balance of the body. This was shown in a paper published by the writer in 1932, entitled "The Rôle of Infection in Burns with Special Reference to Gentian Violet." At that time gentian violet seemed to be the best means that we had of counteracting the pathology exhibited by the burned patient. The burn was protected from all gram-positive organisms and sealed under an eschar; analgesia was obtained and fluid loss prevented. Gentian violet, however, has one weakness; it is not a specific antiseptic against the gram-negatives and sooner or later these germs offered complications. For two years I sought some other antiseptic that would offer all of the advantages of gentian violet plus a more powerful action against the gram-negatives. I investigated the analin and the azo dyes, as well as the chloramides, and wish to present now a report on the use of a combination of acriviolet and brilliant green, acriviolet itself being a loose chemical combination of acriflavine and crystal violet.

When Dr. Firor and I began working with burns in the Johns Hopkins Hospital, there were two main theories as to the cause of toxemia and death in burns. The first theory contends that there is absorption of some split protein in the burned area. Many investigators have reported many substances, isolated from the burned area, the blood and the urine of burned animals or patients. Some of the substances reported were histamine, pyridine, guanidine, ptomaines and primary and secondary proteoses. Among the recent advocates of this theory are Robertson and Boyd, who claim to have isolated primary and secondary proteoses by alcoholic extraction from burned skin. When this extract was injected into unburned animals, they exhibited signs of toxemia and shock. For a time this seemed to have settled the question. However, Underhill and his co-workers at Yale repeated the experiments of Robertson and Boyd, using the same technique and discovered that it was the ethyl alcohol of their extract which caused the animal's toxemia and shock.

Underhill then definitely proved that there was no absorption from either the burned area or the edema fluid around the burn by injecting five times the lethal dose of strychnine into the burns of experimental animals without ob-

Abstracted from a paper presented at the 1938 annual meeting of the New England Association of Fire Chiefs.

taining any evidence of strychnine poisoning. He followed this up with injections of trypan and methylene blue into the burned area and found on tests and on sections that these dyes were not absorbed from the burned area back into the body. If none of these three substances is absorbed, it seems to me very improbable that some split protein should be absorbed in sufficient quantities to cause any toxemia.

Underhill then showed that there is an enormous shifting in the water balance in burned patients, with resulting concentration in the blood. In animals a third degree burn of one-sixth of the body area brings about a loss of one-half the blood volume in thirty hours. This seemed to him to be the cause of the toxemia of burns, and he felt that the logical treatment would be one which kept the blood chemistry normal. This consisted chiefly of intravenous injections of normal saline. A review of Underhill's cases indicated that while his form of treatment was very good in combating primary shock, on the third and fourth day signs of toxemia set in and his patients ran much the same course as those of others.

If, then, there is no absorption from a burn back into the body, and if, even when changes in the blood chemistry are prevented, the symptoms persist, what is the cause of the toxemia in burned patients? Dr. Firor and I began our work with this question. A review of the literature revealed that no work had been done on the bacteriology of burns. Repeated bacteriological studies of fresh burns were done and revealed that for the first twelve hours the areas were practically sterile, but that, beginning around the eighteenth hour, positive cultures could be obtained on all burns. The early culture reports showed a mixed infection, but after seventy-two hours the pus which existed on all burns was practically a pure culture of the beta hemolytic and the gamma streptococcus. In a recent personal communication from Doctor Cruikshank of Glasgow I have been informed that he has confirmed our work on the last two hundred burned patients entering the Royal Infirmary.

There was a definite correlation between the clinical picture and the amount of infection. As the streptococcus multiplied the toxemia increased in severity. With this evidence and with the awareness that burned patients had large open surgical lesions bathed in virulent streptococcic pus, we saw no reason to search for some obscure split protein. Additional pieces of evidence that lent weight to our theory were these: in those patients who became very toxic, blood cultures were positive with the same strain of streptococcus that was found on the burned surface, and in patients dying following a severe burn, the same germs as were found on the burn could be cultured from the heart blood and the lungs. From this we concluded that the fundamental principle in the treatment of burns should be asepsis and anti-sepsis.

We tried various antiseptics in an effort to find a non-toxic agent with a high specific germicidal power. Gentian violet was the outcome of this work.

After its adoption we immediately began to get the results which we had anticipated. If a burn can be kept free from infection there will be no evidence of toxemia. In the two years following the introduction of gentian violet into Johns Hopkins the mortality dropped from 42% to 13%. However, gentian violet was not the ideal antiseptic and contamination by gram-negatives was a constant annoyance. No details of the gentian violet treatment need be given now, inasmuch as it was used in exactly the same way as the new combination of dyes which I shall now discuss.

This combination of acriviolet and brilliant green is the most powerful antiseptic against the gram-positives that will not injure living cells. It also has a high specificity against the gram-negatives. In broth cultures and in the test tube it will not let gram-positives grow in dilutions of one to one million, nor gram-negatives in one to ten thousand. In concentrations of one to one thousand it has a high phenol coefficient against all of the pyogenic organisms. When applied to a burned area it very rapidly forms a tough, flexible eschar which seals off the burn, sterilizing it at the same time. The eschar thus formed prevents fluid loss and brings about analgesia by protecting the nerve endings.

Treatment of Severe Superficial Burns.

Our treatment of a severe, superficial, fresh burn is as follows. When the patient is first seen the burn itself must be ignored if the patient is in shock. This is an imperative fundamental. The shock must be adequately and completely combated. This is done by the usual routine of heat, rest and fluids. When the patient is well out of shock he is placed under a cradle and an aqueous solution of the dye sprayed on by means of an atomizer. There is no clean-up done unless gross contamination is present. The burned area is sprayed every hour during the first day, by which time the eschar is formed. When this has taken place the spraying is discontinued. From this time on the eschar must be watched very carefully every day, or in large burns twice a day, to make certain that no contamination has taken place. Burns of the perineum, burns involving any body orifice, and burns in children who defecate and urinate in bed are rather difficult to keep sterile. If any infection occurs under this eschar it is not masked as it is under the tannic acid crust. The area directly over the infection becomes moist and soft. This contaminated portion should be lifted up with a pair of tissue forceps and excised. The underlying area is then dried with a sterile sponge to remove any gross contamination and the dye reapplied. This careful inspection continues until healing under the eschar is complete or until the granulating surface has built up to the proper height to accept skin grafts. If the eschar becomes contaminated in too large an area to permit painless excision of the infected crust, the whole area can be cleaned up by the use of sterile normal saline compresses. If these compresses are kept moist and are changed every hour, large areas can be com-

pletely freed from infection and eschar in a few hours. The dye is reapplied at this time. The patient is usually very comfortable and unless there is some contra-indication, such as extent or position of the burn, he can be up and about once an eschar has formed. The patient is on house diet and can handle his food and fluid intake adequately.

First Aid Treatment.

Burned patients seen by the members of the fire department have just received their lesions. The main aim is to take care of the patient during his first aid period and to place him in the hands of the doctor who will take care of him later in the best possible condition. It is instinctive to confuse first aid with activity because the spectators and the patient get a satisfaction out of seeing something done. When elaborate first aid kits are opened and highly-colored antiseptics and bandages are taken out and applied to the patient, everyone tends to feel that medical aid is begun, and that the condition of the patient will be the better for it. This is true in certain cases, such as hemorrhage, but it is not true for the burned patient. The initial shock is the important thing to combat. When you see a fresh burn your immediate thought should be to make sure that the patient is not still being burned. Investigate his clothing rapidly and put out any smoldering fire in his garments. When this has been done, begin the treatment for shock at once.

The three fundamentals in the treatment of shock are: heat, rest and fluids. Firemen need only be concerned with the first two. Don't be in too much of a hurry to move the patient to a hospital. As he is badly shocked, he will do better if given a chance to recover before he undergoes the added exertion of being carried to an ambulance and hurried to a hospital. This is especially true if the facilities for transportation are not of the best. Put a blanket on the ground and let the patient lie down. Cover him with several more blankets. If local heat can be applied in the form of hot water bottles or chemical heating pads, so much the better. Putting the patient on the ground helps the circulation to the brain, and keeping him warm tends to keep the body from cooling off, as it will in response to the lowered circulation and blood pressure. These symptoms of shock, unless they are combated, can bring about very early death. I have seen patients die within an hour after being burned, simply because they were handled roughly and allowed to become chilled. After the explosion of the German Zeppelin at Lakewood, newspapers and periodicals regaled us for weeks with startling pictures of the victims. Several were compelled to pose for the cameramen and many more were herded around for quite a while in the excitement. From the best reports obtainable I have concluded that at least a few that died did so because the shock was not combated. They were not allowed to live long enough to have been given a fighting chance to overcome their burns.

There is absolutely no urgent rush to begin the treatment of the burned areas themselves. The patient, as a whole, must be considered first. An hour's delay, when the patient is kept warm and prone, will in most cases do a great deal of good and never any harm, whereas too much rush will do no good and will frequently bring about death.

Don't attempt to remove the clothing from a patient with a large burn. Don't insist that salves or liquids must be applied to the burned areas immediately. Treat the patient as though he were very sick, exceedingly weak and extremely fatigued. Imagine what you would want under the same circumstances and you will get the answer. Make him warm and comfortable and allow him to get over some of his initial shock.

This routine in handling severe burns will alleviate pain, will prevent unnecessary deaths and will place the patient in the hands of the doctor in much better condition than any attempt at first aid by motion and commotion.

Fire Extinguisher Explosions.

Exactly how many hundreds of thousands of fires are extinguished by the use of hand fire extinguishers, how many millions of dollars of property they save from destruction by fire, and how many hundred lives are saved by them each year is not known. However, the important rôle played by hand fire extinguishers in extinguishing fires in their incipiency is a matter of common knowledge. Statistics furnished by the U. S. Bureau of the Census show that 341,000 fire extinguishers of one type alone were sold in 1937. The Chemical Fire Extinguisher Association (Member N.F.P.A.) reports that the manufacturers making up its membership sell approximately 625,000 recharges for one type of extinguisher alone each year. These figures give some idea of the widespread use of hand fire extinguishers, and reports of fires received by the N.F.P.A. Department of Fire Record each day are proof of their value in controlling potentially serious fires. To cite a practical example, the fire chief of a large factory in New York State reports that 320 (or 70 per cent) of the 455 fires occurring in the buildings under his care during a recent five-year period were extinguished by the use of portable first-aid fire appliances without the assistance of automatic sprinklers or hose streams.

To be sure, hand fire extinguishers sometimes fail to control fires, which may also occasionally be said of other forms of public and private fire protection. It sometimes happens that they have been rendered inefficient or actually inoperative by improper maintenance or lack of care.

The N.F.P.A. has received requests from members for records on the subject of explosion of chemical fire extinguishers. Such accidents are now so very

rare that it seems well first to consider the whole subject of care and maintenance of extinguishers, the neglect of which may pave the way for such occurrences.

A fire extinguisher is a mechanical device into the design of which has gone the utmost effort to simplify its actual operation in the fire emergency. It is perhaps due to this important feature of simple and ready operation that many plant operating men overlook the need for the same care that they give to other mechanical devices in the plant. Then, too, the fire extinguisher is not an item of daily use. It hangs in its place many times literally forgotten until the fire emergency comes. Yet it should be obvious that no other piece of equipment merits more careful maintenance.

Weakened by corrosion which pitted the interior and caused a leak that had been soldered, this extinguisher exploded.

The principles, design and instructions for care and handling of fire extinguishers are contained in convenient form, well indexed and fully illustrated in the "Regulations on First Aid Fire Appliances" prepared by the N.F.P.A. A copy of this pamphlet should be in the hands of every plant manager, shop superintendent and other employee responsible in any way for the safety of the plant from fire.

Of primary importance is the use of proper charges for extinguishers and of care in the charging operation. Some extinguishers must be recharged annually and their neglect may result in the chemicals having lost their potency. Improper chemicals may cause corrosion that will result in leakage or impairment of mechanical strength. Wrong amounts of chemicals in the charge or substitutes in a pressure type device may result in pressures inadequate for effective discharge or too high for full safety. Accumulations of dirt or improper cleaning of water-solution type devices may cause clogged outlets, hose, or nozzle.

No mechanical device may be expected to last forever. Hose deteriorates, gaskets become worn, or mechanical injury may weaken the structure. Placing of fire extinguishers where they are subject to occasional blows, or improper mounting where they are subject to falls, or rough handling during use or recharging may leave the device in a seriously weakened condition. Consider

what may happen to a soda-acid unit which should be protected from frost, but which is carelessly left for the winter in an unheated location. The damage due to freezing may not be evident upon inspection, but may, nevertheless, have impaired the strength of the shell greatly. Again, at the recharging period, carelessness may result in damaging threads on pressure devices, or in transposing caps on different extinguishers. Fire equipment should consist of standard devices, using the recharges designed for them and should receive inspection and recharging service by intelligent personnel on a definite schedule. Only thus may equipment be kept in proper condition and, if mechanically damaged, removed from use and replaced immediately.

That failure to take proper care of pressure type fire extinguishers may result in their mechanical failure under the pressure developed in discharging is obvious. That the occurrence of such extinguishers bursting is very rare indeed is attested by the fact that a review of the records of the N.F.P.A. reveals only a very small number of cases out of millions of operations.

While there are many cases of rupture of pressure vessels, such as boilers, compressed air tanks, gas vessels, etc., recorded, the fire extinguisher operating on internally generated pressure cannot be considered as falling in this same class of pressure storage device. The fire extinguisher has an internal pressure only when it is operated and the approved types are not fully closed, having a permanent opening through the hose which provides for immediate and continuous discharge, thus providing relief and keeping the pressure comparatively low. It is only when the outlet is allowed, by poor maintenance, to become plugged by foreign material that the pressure may be held. Furthermore, all extinguishers labeled by Underwriters' Laboratories, Inc., are designed, in connection with their own charge, to be amply strong to retain the pressure that would be developed if the outlet were plugged. Each labeled extinguisher is put under such an individual test at a pressure some four times normal operating pressure, before it is labeled and leaves the manufacturer's plant. It, therefore, follows that in addition to the outlet being clogged through neglect of proper maintenance, or through improper charging, the strength of the extinguisher must have been impaired through abuse or injury to permit it to rupture.

These conclusions are borne out by the paucity of the record and the fact that it shows that these accidents involved mostly unapproved devices and other obvious causes of failure. A record of the nine such cases since 1930 on file in the N.F.P.A. Department of Fire Record is summarized below. This is not presented as a complete record; other similar accidents have presumably occurred, but have not been reported to the N.F.P.A.

HOLLY RIDGE, LA., AUG. 4, 1932. A grocery clerk's attention was drawn to a sizzling noise issuing from a 2½-gallon soda-acid fire extinguisher. He

immediately proceeded to carry out the extinguisher after removing it from its hanger and turning it upside down. Upon reaching the rear doorway the extinguisher exploded, opening the soldered joint near the top. The top of the extinguisher struck the ground and the shell struck him in the chest, injuring him fatally. This extinguisher was an old one and was last recharged in August, 1931. Upon examination the extinguisher appeared in good condition, but the fact that it was carried, in an inverted position, for some forty feet without discharging would apparently indicate clogging of hose or nozzle. The soda and acid used in charging the extinguisher had been purchased in bulk; after the explosion it could not be positively determined whether an excessive quantity of the chemicals had been used.

Extinguisher that exploded in Rivière du Loup, Quebec, February, 1938.

MONTREAL, QUEBEC, JAN. 10, 1933. A fire department type soda-acid extinguisher exploded when put in operation during a fire by a lieutenant of the fire department. He had removed the extinguisher from the hose wagon upon arrival at the fire, and when inside the building he partially up-ended it and shook it to mix the solution. He then completely inverted the extinguisher. Almost immediately there was an explosion and the extinguisher was driven upwards. The body of the extinguisher struck him under the chin, causing severe cuts. After the accident the extinguisher was removed to fire department shops and tested with hydraulic pressure. Twice the cap blew off at pressures between 225 and 250 pounds. Threads on the cap appeared good, but those on the collar of the extinguisher were somewhat worn. Even when screwed down tight there seemed to be a slight play in the cap. It is understood that a fire department order specifying that all chemical extinguishers be sent to the shops for testing every six months had not been strictly carried out. The extinguisher did not bear the label of Underwriters' Laboratories.

HASTINGS, NEW ZEALAND, MARCH 25, 1933. Fire broke out in a small shed at the rear of the post office building. The fire brigade was summoned, but in the meantime three men procured extinguishers and attempted to fight the fire. A post office clerk bumped a soda-acid extinguisher on the ground in an attempt to make it work, as he thought it was clogged. Just as a slight trickle of liquid began to issue from it the extinguisher exploded. The injuries he received proved fatal. At the inquest which followed the accident the postmaster gave evidence that the extinguisher was in good working order and that

it had been cleaned and recharged in November, 1932, in accordance with instructions. However, it appeared that the cause of the explosion was a blockage of the nozzle by rust. While the reports do not state the construction of the extinguisher, the rust would indicate that it may have had an ordinary steel shell rather than the standard copper shell. The refill used in recharging this extinguisher was not that supplied by the manufacturer.

PHILADELPHIA, PA., JULY 23, 1933. A small fire occurred in a laundry, and a local call was sent to an engine company. When this company arrived they found that the fire had been put out. The engineer of the plant had tried to use an old soda-acid extinguisher of the break bottle type, but internal pressure burst the extinguisher, causing his death. The fire department investigated this accident and it appears that the discharge valve of the extinguisher had been broken off sometime previous to the fire and was brazed together with the handle, which was also broken off. When the explosion occurred the crimped head which separates the discharge valve section from the body of the extinguisher let go. It appears that the extinguisher was recharged by one of the employees just three weeks prior to the accident, but there is a question as to whether the proper amounts of soda and acid were used in the recharging. Fire department officials, however, believe that when the handle and discharge valve were brazed it so affected the metal at that point that when pressure was produced by the chemical reaction within the shell the whole head blew off.

ERIE, PA., SEPT. 16, 1937. An engineer of a hospital was demonstrating the use of a soda-acid extinguisher before a class of graduating nurses. He turned the extinguisher upside down and apparently it worked satisfactorily. Someone mentioned that the extinguisher was leaking around the cap, and just as the engineer leaned over to locate the leak the extinguisher exploded, separating the body of the extinguisher from the cap. The body of the extinguisher struck his head, continued upward, and embedded itself in the ceiling of the room. He later died from the injuries. Upon request of hospital authorities the Erie Fire Department inspected the extinguisher by recharging it and replacing the cap. The extinguisher was then turned over, and as pressure built up leakage again occurred around the cap, but it did not blow off this time. It is obvious that the cap was not screwed home at the time of the accident; perhaps the threads were defective, or the cap not designed for the extinguisher. There is evidence that the gasket was homemade.

REDWOOD CITY, CALIF., SEPT. 22, 1937. Two employees of a manufacturing plant were preparing to fight a fire which started in a storage bin. One man placed a 2½-gallon soda-acid extinguisher in operation and held it in an almost horizontal position under his right arm and directed the nozzle with his left hand. As the pressure built up in the extinguisher a stream issued from the nozzle, but not of normal volume. Before the men could realize that they were in danger, the extinguisher burst. The head of the extinguisher blew off and the body shot backwards from under the operator's arm, striking the other employee on the head, inflicting injuries from which he later died. This extinguisher did not bear the label of Underwriters' Laboratories. Failure occurred at the joint connecting the head to the shell. The exact cause of the failure is not definitely known, but investigators found that the screen over the outlet to the hose inside the head was partly clogged with sediment, presumably due to failure to clean the extinguisher properly at the last recharging. This may have

accounted for excess pressure sufficient to rupture a substandard extinguisher shell. Another theory is that the extinguisher might have been weakened by some previous injury.

WALTHAM, MASS., APRIL 28, 1938. A fire department officer attempted to put out a brush fire near a building with a fire department type soda-acid extinguisher. The extinguisher did not function when he inverted it, so he shook it vigorously. An explosion resulted. Part of the extinguisher struck him in the leg, causing a severe wound. An investigation showed that the bottom half of the extinguisher blew off and the sides tore open. It was about thirty years old and did not bear the label of Underwriters' Laboratories. It had been repaired by soldering and its walls near the point of fracture had been partly eaten away by corrosion.

RIVIERE DU LOUP, QUEBEC, FEBRUARY, 1938. A fireman at a chimney fire inverted a soda-acid extinguisher which started to function normally, but then exploded without warning. The fireman was badly injured. The illustration on page 373 shows the character of the failure of the extinguisher shell. The appearance of the extinguisher suggests that the failure may have been due to the cumulative effect of rough handling and mechanical injury over a period of years. No information is available as to the character of the charge used. This extinguisher did not bear the label of Underwriters' Laboratories, but there is no evidence that its original construction was defective.

LAKE BEAUPORT, QUEBEC, FEBRUARY 23, 1939. A large wooden hotel frequented by skiers caught fire. A guest near to where the fire started grabbed an extinguisher and inverted it. As no liquid was discharged from the hose, the man shook the extinguisher. An explosion occurred and the man was fatally injured when struck by the bottom of the extinguisher. Subsequent examination showed that the explosion blew off the top part at the soldered joint.

It is significant that only nine extinguisher explosions have been reported to the N.F.P.A. since 1930, and that every case indicates some obvious defect in the extinguisher or its maintenance that might have been detected by proper care. For every life lost in these explosions it is safe to say that thousands have been saved by extinguishers used successfully to control fires in their incipiency.

It should be noted that the factors appearing two or more times are: (1) the use of extinguishing materials other than those supplied by the manufacturers or carelessness in recharging; (2) the use of extinguishers not bearing the label of Underwriters' Laboratories, Inc.; (3) defective threads (or exchanged or mismated caps) and (4) repairs attempted instead of replacing extinguisher.

It is only in the very unusual combination of circumstances where the shell does not have the proper strength, by reason of freezing or other mechanical injury, and at the same time the pressure is excessive, by reason of clogged outlet or improper chemical charges, that trouble may be expected.

Furniture Bleaching.

Report by South-Eastern Underwriters Association,
(Member N.F.P.A.).

The bleaching of furniture before applying finishes in order to produce novel effects is a comparatively new development in furniture factories. A strong solution of hydrogen peroxide is the bleaching agent most favored by the furniture industry in the South. The hydrogen peroxide solution is non-hazardous in itself, but carries a large amount of available oxygen. As soon as the material began to be used, fire protection engineers recognized that fires would result when the solution was used in the presence of finishing materials which are subject to spontaneous ignition when oxidized beyond their normal pace. Accordingly, engineers inspecting furniture factories have made it a practice to investigate the use of this bleaching material and to recommend that it be not sprayed, but mopped on in sections remote from finishing processes.

A fire, which illustrates the potential hazards when hydrogen peroxide bleaching is done without regard to fire possibilities, occurred in a furniture factory in Thomasville, N. C., on January 16, 1939. It was caused by spontaneous ignition of dried lacquer residue as a result of spraying the bleaching solution in an ordinary all-metal spray booth located on the second floor of the machine building. The booth was vented to the outside directly through the wall by means of the usual fan in the metal exhauster. The booth had long been used for spraying lacquer sealer and was not partitioned off from the remainder of the finishing area.

Until a week before the fire, bleaching solution had been mopped on furniture by hand, but as a large order for bleached furniture was received, the old spray booth was being used for spraying hydrogen peroxide. The fire started with a flash fire less than an hour and a half after spraying was stopped for the day. Ninety-seven sprinklers, including a head in the spray booth, operated. Three hose streams were also used to control the fire, which spread through the outside wall and to a concealed roof space. The total loss, including use and occupancy loss, was about $28,000, mostly from water damage.

While other factors, such as the improper location of the spray booth, accumulations of lacquer residue, lack of waterproofing for floors, and arrangement of factory processes contributed to the extent of this loss, it is well established by this fire that bleaching material in contact with lacquer or other oxidizable residues is a positive hazard.

NOTE: Subsequent to the receipt of this article, a fire occurring from the same cause under very similar circumstances has been reported from Staunton, Va. This fire, occurring on March 3, 1939, involved a loss estimated at over $400,000.—Ed.

Insane Asylum Fire, Giffard, Quebec.

An institution fire of serious proportions occurred at Giffard, Quebec, just outside the Quebec City limits, on the morning of February 16, 1939. A large part of the St. Michael the Archangel Hospital, housing 2812 insane patients, was destroyed. While the large monetary loss of $525,000 was serious, it was secondary to the tremendous problem of moving and caring for the large number of inmates. This work was particularly difficult because of the excitement of the fire and the zero weather outside. Also serious was the problem of providing other quarters for the inmates, as other institutions in the Province were already overcrowded. Fortunately under the guidance of the nuns operating the hospital, and with the assistance of all available guards and police, all of the patients were safely removed and housed in temporary quarters.

The hospital was said to be one of the largest and oldest insane asylums on the North American continent. It was founded in 1845 and for many years had been operated by the Roman Catholic Order of Grey Nuns.

The buildings involved in the fire were four- and five-story brick-joisted structures having Mansard roofs. The same institution had been the scene of several other serious fires. In 1930 the men's wing was destroyed. In 1875 twenty women inmates lost their lives when the central section was burned. The general type of construction was such as to favor the rapid spread of a fire once under way.

The institution was divided into three large areas by fire walls which separated the east and the west wings from the central section. At the time of the fire there were 1730 men and 1082 women inmates in the institution, which was largely financed by appropriations from the Provincial Government. The amount of the appropriations had recently been increased from a basis of $200 per inmate each year to $216. This was done with the understanding that the additional money would be devoted to improving the institution and providing better fire safety. Unfortunately the fire occurred before improvements could be made this Spring.

Story of the Fire.

The blaze apparently started about 8 a.m. in one of the recreation rooms for men located on the third floor of the east wing. As soon as the fire was discovered the nuns started moving the nearest men inmates to other portions of the building. It was hoped that it would not be necessary to move the patients outside of the building. However, fanned by the high wind, the flames spread to the infirmary, tailor shop and large chapel in the men's wing. Before long it

A part of the burning St. Michael the Archangel Hospital for the insane at Giffard, Quebec, after the fire had been burning all through the day of February 16, 1939. The fire was not brought under control until the following day, at which time much of the institution had been destroyed with more than $500,000 loss.

became obvious that the inmates would have to be removed from the institution. All available city, provincial and Royal Canadian Mounted Police were called to assist the attendants and nuns. The inmates were taken out in remarkably good order between double rows of guards. They were placed in buses which took them to temporary quarters elsewhere. The more violent were placed in city jails, others were sent to hospitals, and those more mildly afflicted were sent to private homes until other quarters could be found. One hundred were placed on a special train and sent to an asylum in Montreal.

Although the institution is outside of the city limits, the Quebec Fire Department sent the greater part of its apparatus and manpower to fight the blaze. At its height one hundred firemen were directing twelve hose streams against the flames. The severe cold was a serious handicap to the firemen and they were gradually forced to fall back to the fire wall at the central section. After a twenty-four hour fight the central building was saved, but most of the sections in which inmates had been housed were destroyed.

Conclusions.

The total loss from this fire was set at $525,000. It is believed that the fire may have been the work of a pyromaniac. Several small fires are reported to have occurred during the several weeks prior to this large blaze.

This was at least the third large fire loss which has occurred in the same institution. Even after the fire of 1930 had destroyed the men's wing it appar-

ently was replaced without much thought as to fire or life safety, and although appropriations had recently been made to provide improvements, nothing had been accomplished at the time the fire occurred. Incidentally, the Provincial Fire Commissioner of Quebec does not have authority to make inspections or make safety recommendations for the various Provincial hospitals and institutions, but inspections are made by inspectors of public buildings.

This fire shows that desirable structural changes needed to provide fire safety may require so much time and money that they are not made before a major fire occurs. To provide fire protection for existing insane asylums without waiting for expensive structural changes and without undue inconvenience to routine operations, automatic sprinkler equipment should be installed.

This fire also shows that monetary losses are not the only consideration in measuring the need of fire protection for asylums. The problems of moving insane persons from burning buildings and of providing other quarters for them during rebuilding operations are of major importance.

Fires in Which There Was Loss of Life.

First Quarter, 1939.

Since the publication of the January, 1939, QUARTERLY, the N.F.P.A. Department of Fire Record has received reports of 247 fires in which there was loss of life. Four hundred and sixty persons lost their lives as a result of these fires. During this period, the following fires were reported in the United States and Canada, which caused the loss of more than five lives each.

DECEMBER 7, 1938, COLUMBUS, OHIO. Seven elderly men and women were killed in a fire which damaged a Rest Home. Though the cause of the fire was not definitely established, it was brought out at the inquest that the electric wiring was in a deplorable condition, with all circuits overloaded and that there was clearance of only five inches between the furnace and the joists above. (H-43028.)

DECEMBER 29, 1938, ST. JAMES, QUEBEC. A defective chimney was the cause of a dwelling fire in this suburb of Winnipeg, which took the lives of a mother and her five children. The chimney had a hole in it, through which sparks apparently escaped, setting the house afire at about midnight. The father and one son escaped, but the remainder of the family was trapped. (H-43029.)

JANUARY 21, 1939, MCGREGOR, IOWA. Two men, two women, and four children were trapped in a fire which razed three small apartments located over a furniture store. The cause of the fire was not determined, but it was believed to have started in a small shed at the rear of the building where upholstery supplies were kept. The victims were prevented from jumping from the windows by screens which they were unable to displace. (H-43030.)

JANUARY 29, 1939, NEWTOWN, OHIO. Fire trapped and wiped out a family of six, including four children. The cause of the fire which destroyed their four-room cottage was not established. (H-43031.)

FEBRUARY 3, 1939, SYRACUSE, N. Y. Eight firemen were killed by the collapse of a brick five-story building while they were preparing to leave after having extinguished a fire. A deputy chief, who was in the building but escaped injury, died two days later as the result of shock and overexertion. (H-43079.)

FEBRUARY 4, 1939, WEST POINT, VA. Nine colored children, trapped on the second floor of their rural home, burned to death after their father had carried his wife and two-hours-old baby to safety. Origin of the fire is unknown. (H-43032.)

FEBRUARY 17, 1939, GREENWICH, VA. A father and his seven children were trapped and burned to death in a fire which destroyed their home. The mother and a two-year-old son escaped. It is reported that the father went upstairs to wake the other children, when the whole house burst into flames, cutting off all escape. The cause of the fire was not established. (H-43033.)

MARCH 2, 1939, HALIFAX, NOVA SCOTIA. Fire which destroyed the Queen Hotel during the early morning took an estimated toll of 28 lives. The building was without any form of alarm devices and the fire had considerable headway when discovered. Unprotected horizontal and vertical openings allowed the fire to spread quickly throughout the building, trapping the occupants. (See page 310.)

Loss of Life Fires, January-March, 1939.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Class of Fire	No. of Fires	Men	Women	Children	Total
Airplanes	6	17	2	0	19
Amusement places	1	0	0	3	3
Apartments, rooming houses, tenements and hotels	40	47	32	20	99
Automobiles, trucks	13	14	2	6	22
Tank truck fires	1	2	0	0	2
House trailer fires	1	0	1	0	1
Barns	3	2	1	0	3
Chemical laboratories	1	1	0	0	1
Churches	3	2	1	0	3
Dwellings—rural	66	25	20	89	134
Dwellings—urban	74	25	40	48	113
Fire Stations	1	2	0	0	2
Garages	4	4	2	0	6
Manufacturing occupancies—miscellaneous	6	5	0	2	7
Mercantile occupancies—miscellaneous	4	12	0	0	12
Mining property fires	3	4	0	0	4
Municipal buildings	1	1	0	0	1
Oil refineries	2	4	0	0	4
Out of door fires	7	6	1	2	9
Railroad cars	1	1	0	0	1
Response to alarms	7	9	0	0	9
Restaurants	2	4	1	0	5
Totals	247	187	103	170	460

*This table is made up from those reports received by the Department of Fire Record between December 11, 1938, and March 25, 1939. A few of the fires included herein occurred prior to December 11, 1938, but were not reported until subsequent to that date.

Causes of Loss of Life, January-March, 1939.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

Class of Fire	Men	Women	Children	Total
Airplane fires	17	2	0	19
Asphyxiation	4	6	4	14
Automobile or truck collisions and fires	12	2	6	20
Collision of automobile with tank truck	2	0	0	2
Children alone in house	0	0	2	2
Children playing with matches	0	0	5	5
Clothing ignited (other than following classifications)	4	9	4	17
Bonfires, rubbish fires	1	1	2	4
Burning gasoline	2	1	0	3
Candle	0	1	1	2
Christmas tree fire	0	1	0	1
Falling into fire	0	0	1	1
Stove	1	14	3	18
Matches	0	4	0	4
Oil stove or oil heater	0	2	5	7
Smoking (see also smoking in bed)	4	1	0	5
Entering or re-entering a burning building	0	2	1	3
Escaping fires; jumped, fell or drowned	4	0	0	4
Explosions, miscellaneous	1	1	0	2
Chemicals	1	0	0	1
Dynamite	3	0	0	3
Furnace	1	0	0	1
Illuminating gas	2	1	0	3
Fire fighting—firemen	9	0	0	9
Overexertion by firemen	3	0	0	3
Fire fighting—private individuals	3	0	0	3
Flammable liquids and vapors fires:				
Alcohol ignited	4	0	0	4
Gasoline lanterns and stoves	1	1	2	4
Gasoline used for cleaning purposes	3	1	7	11
Gasoline fires, not otherwise classified	1	0	0	1
Kerosene used to start a fire	1	5	6	12
Naphtha ignited	1	0	0	1
Oil refinery fires	3	0	0	3
Oil storage tank fires	4	1	0	5
Paint and varnish fires	1	0	0	1
Mine fires and explosions	4	0	0	4
Response to alarms (collisions)	5	0	0	5
Thrown from apparatus	2	0	0	2
Smoking in bed	9	2	0	11
Trapped in burning building	74	45	121	240
Totals	187	103	170	460

Foreign Fires.

Six fires involving large losses of life have been reported during this quarter from outside the United States and Canada. These figures are not included in the tables, but summaries of these fires are given below.

DECEMBER 16, 1938, ALEXANDRIA, EGYPT. Eight persons were burned to death in the Alexandria Custom House when twenty cases of motion picture film caught fire during an inspection by customs officers. (H-43039.)

DECEMBER 20, 1938, BARBACENA, BRAZIL. At least eighty-two persons were killed, many of them burned to death, when passenger and freight trains collided and burst into flames. (H-43034.)

DECEMBER 24, 1938, PUEBLA, MEXICO. The old Mexican Christmas custom of setting off fireworks cost the lives of three children and dangerously injured nine other youngsters when an explosion wrecked a crowded toy and fireworks store. (H-43041.)

JANUARY 9-16, 1939, VICTORIA, AUSTRALIA. At least sixty-three fatalities and property loss of more than $2,000,000 resulted when bush fires swept large sections of Southern Australia. Over 1000 homes, 40 mills and 35 other buildings were reported destroyed. (H-43040.)

JANUARY 22, 1939, FUKUOKA, JAPAN. Ninety-two miners were killed in an explosion in the Onura coal mine at this place. (H-43035.)

MARCH 1, 1939, HIRAKATA, JAPAN. Approximately 200 persons were killed, at least 200 others injured and 5800 made homeless when an army arsenal exploded in this suburb of Osaka. The cause of the explosion was undetermined. Flames following the explosion destroyed some 600 homes not otherwise demolished by the force of the blast. (H-43036.)

Typical Loss of Life Fires.

Airplane Fires.

DECEMBER 29, 1938, NEAR SAN ANTONIO, TEX. Four men were killed when their airplane took fire in the air and crashed in flames. (H-43042.)

JANUARY 13, 1939, MILES CITY, MONTANA. Three men and a woman were instantly killed when a large airliner crashed. A flash of fire was observed shortly after the plane left the airport, and she crashed, bringing death to her pilots and two passengers. (H-43043.)

MARCH 19, 1939, LOS ANGELES, CALIFORNIA. Two men were burned to death when their light monoplane crashed into an electric power line and fell in flames. (H-43044.)

Automobile, Truck and Tank Truck Fires.

NOVEMBER 8, 1938, SALINA, KANSAS. Two men were burned to death near this city when a gasoline transport collided with a freight truck and burst into flames. (H-43048.)

DECEMBER 1, 1938, ANN ARBOR, MICHIGAN. Two men were burned to death when their alcohol laden coupé crashed into a truck and burst into flames. The victims were unable to extricate themselves from the wrecked car. (H-43047.)

DECEMBER 31, 1938, ROANOKE, ALABAMA. Four high school boys were burned to death following a collision of a school bus and an automobile. The bus in which the boys were riding caught fire immediately after the impact. (H-43046.)

Clothing Ignited.

DECEMBER 4, 1938, SAN DIEGO, CALIFORNIA. A five-year-old girl was burned to death when her dress was ignited by a rubbish fire in her back yard. (H-43054.)

DECEMBER 23, 1938, NEW YORK, N. Y. A university student died of burns received when his clothing became ignited during research experiments in a chemical laboratory. His apparatus exploded and the flash ignited his clothes. (H-43056.)

Acme.

Two firemen were killed and two others seriously injured when this fire truck crashed into a tree after colliding with an automobile at an intersection. During this first quarter of 1939, the N.F.P.A. Department of Fire Record has received reports of the death of five firemen as the result of such accidents. (H-43061.)

DECEMBER 26, 1938, LAWRENCE, MASSACHUSETTS. An elderly man was burned to death when he set his clothes afire while lighting his pipe. (H-43049.)

DECEMBER 31, 1938, PHILADELPHIA, PA. Her clothing ignited in her efforts to extinguish a Christmas tree fire, an elderly woman was burned to death. She had used candles to illuminate the tree. (H-43060.)

JANUARY 6, 1939, LOWELL, MASS. A three-year-old girl died of burns received when her clothing became ignited while she was playing with matches. (H-43053.)

FEBRUARY 11, 1939, WICHITA, KANS. An elderly woman died of burns received when her night clothes were ignited by a stove. (H-43051.)

Escaping Fires.

MARCH 6, 1939, ST. PAUL, MINN. A university student died in the hospital of injuries received when he jumped from a third floor window to escape a fire in a fraternity house. (H-43055.)

Explosions.

DECEMBER 26, 1938, ANTHONY, KANS. One man was killed and two others injured when the gas furnace of the Harper County Courthouse exploded. The explosion occurred when the men tried to light the furnace after it had been turned out for several hours, without first lighting the pilot flame. (H-43059.)

DECEMBER 28, 1938, CHRISTIANSBURG, VA. An explosion—presumably of natural gas—killed two miners and severely burned five others in an an-

Acme.

One man was killed and two others seriously injured when an explosion wrecked this varnish factory. Fumes from the varnish became ignited, possibly by a spark from an electric motor. (H-43068.)

thracite mine. One of the victims was instantly killed, the other died of burns four hours after the blast. (H-43058.)

JANUARY 30, 1939, FORT COLLINS, COLO. Two men were killed and several others injured when three truckloads of dynamite exploded. The explosion occurred while some of the dynamite was being thawed for use and became overheated. The blast destroyed a $25,000 office building, and was felt twenty miles away. (H-43057.)

Flammable Liquid Fires.

DECEMBER 11, 1938, LONG BEACH, CALIF. Three men were burned to death when a refining tube burst at an oil refinery, spraying them with superheated oil. The fire which followed the bursting of the tube caused about $10,000 damage. (H-43064.)

DECEMBER 23, 1938, MALONE, N. Y. Three children were killed and their mother critically burned when fumes from a pail of gasoline exploded. The mother was using the gasoline to clean the children's clothes when the explosion occurred. (H-43065.)

JANUARY 24, 1939, TAYLORSVILLE, MD. Using kerosene to start a fire in a wood stove, brought death to a farmer. He was enveloped in flames and his wife and two children were powerless to aid him. (H-43066.)

FEBRUARY 18, 1939, MINNEAPOLIS, MINN. An explosion which converted a gasoline filling station into a roaring furnace brought death to the attendant. He was attempting to thaw frozen water pipes with a blowtorch in a fume-filled basement. (H-43067.)

FEBRUARY 27, 1939, TRENTON, N. J. One man was killed and two others seriously injured when an explosion wrecked a varnish manufacturing plant.

It is believed that varnish fumes were ignited by a spark from an electric motor. (H-43068.)

Re-entering Burning Building.

DECEMBER 22, 1938, JERSEY CITY, N. J. A woman was killed when she ran back into her burning home in an effort to save a picture of her late husband. (H-43069.)

FEBRUARY 20, 1939, LEWISTON, PA. A seven-year-old girl died after rushing back into her burning home in the mistaken belief that her mother was there. (H-43070.)

Smoking in Bed.

DECEMBER 17, 1938, NEW YORK, N. Y. A man was burned to death when he fell asleep while smoking a cigarette. (H-43072.)

DECEMBER 28, 1938, SALINA, KANS. A man was suffocated by a fire which was caused by his falling asleep while smoking in bed. (H-43071.)

Trapped in Burning Buildings.

DECEMBER 16, 1938, ISLAND FALLS, MAINE. A father and his two children were burned to death when fire, believed to have been caused by an overheated stove, leveled their home. The man's body was found near the front door which had been boarded up. His daughters were unable to reach the rear door. (H-43073.)

DECEMBER 24, 1938, NEWARK, N. J. Three adults and one child were trapped and burned to death when fire swept a three-story double house. Investigators expressed the belief that the fire was caused by an oil stove explosion. (H-43074.)

DECEMBER 26, 1938, NEW YORK, N. Y. A woman was burned to death on the fifth floor of a tenement when flames, originating in the hallway of the first floor, mushroomed through the top floor after spreading up the stair well. Nearly a score of persons were rescued over ladders raised by the fire department. The cause of the fire was not established. (H-43075.)

DECEMBER 27, 1938, HUNTINGTON, W. VA. Four small children perished when fire swept their two-story log home about 15 miles from this city. The fire apparently was caused by a defective chimney. (H-43076.)

DECEMBER 31, 1938, RUMFORD, MAINE. Two adults and three children were burned to death when fire destroyed a three-story frame hotel. The cause of the fire, which swept the building just before midnight, was undetermined. The chief of the fire department said, however, that indications were that the fire started in the basement and smouldered several hours before bursting through. (H-43077.)

JANUARY 7, 1939, NEW YORK, N. Y. Two boys were asphyxiated in the locked living room of their apartment by smoke from a fire which one of the boys was said to have started by setting fire to a bundle of newspapers on a chair. An older brother was overcome, but was revived through the use of an inhalator. It was reported that their mother was in the habit of locking them in the room whenever she left them alone. (H-43078.)

Annual Sprinkler Tables—1939.

The annual sprinkler tabulation is published this year for the forty-third consecutive year. The tables which follow show the actual fire experience with automatic sprinkler equipments in seventy-six thousand two hundred thirty-nine fires. This is not intended as a complete statistical report of fires in sprinklered properties; it includes only those fires reported to the N.F.P.A. Department of Fire Record in sufficient detail to give the data necessary for the tables.

This record of fires represents only a fraction of the total number of fires during the year in sprinklered properties. Numerous fires, extinguished by one or two heads with slight loss, do not find their way into these records. If it were possible to include a complete record of all fires, the efficiency of sprinkler performance shown by these tables would approach more nearly 100%.

The total number of sprinklered fire reports recorded during the past year was 839, including 65 fires in which the sprinklers were not a factor.

When reviewing the detailed tabulation of unsatisfactory sprinkler performance it should be noted that these fires represent a small percentage of the total number included in the record and that they are compiled not with the thought of emphasizing the relatively few cases where sprinkler operation is unsatisfactory, but pointing the way toward better performance by indicating those factors which should receive attention.

Large Loss Fires Due to Unsatisfactory Sprinkler Operation.

Each year several cases of sprinkler failure where the fire resulted in large loss are included in these tables. Believing these to be of sufficient interest to warrant some additional attention, the Department of Fire Record inaugurated last year a new feature in the annual tabulation of sprinklered fires. This section includes a brief description of the failure of sprinkler protection in all those fires where the loss is known to be $100,000 or over. Reports received during the past year included five such fires. They are individually summarized below.

FEBRUARY 10, 1938. Fire of unknown origin destroyed a furniture factory at Lewiston, Maine, with a loss of approximately $103,500. The reason for the unsatisfactory sprinkler operation has not been definitely established, but the hazard of the occupancy may have been too severe for average sprinkler equipment. (S-76218.)

FEBRUARY 17, 1938. In a cottonseed oil mill at Helena, Arkansas, a fire of unknown origin spread with such rapidity as to open a large number of sprinkler heads, which overtaxed the limited water supply. The loss amounted to $160,000. (S-76217.)

MARCH 6, 1938. A cottonseed oil mill at Oklahoma City, Oklahoma, sustained damages amounting to $150,000 as the result of a fire which started in the seed warehouse.

The fire spread with great rapidity due to the large accumulations of lint and opened more sprinkler heads than could be adequately supplied by a 50,000 gallon gravity tank. The sprinklers were promptly shut off by the fire department when that supply was exhausted lest the pressure of the municipal water supply be reduced by the demands of the sprinkler system. (S-76216.)

MARCH 20,1938. The sprinkler system having been shut off for neglected minor repairs, fire destroyed an electrical appliance manufacturing plant at Mt. Vernon, N. Y. The loss was approximately $150,000. (S-76052.)

MARCH 22, 1938. A dust explosion in a Minneapolis, Minnesota, grain elevator resulted in damage amounting to $200,000. The sprinkler system was ruptured by the blast and was of no value. (S-76222.)

SECTION I.

Summary of Unsatisfactory Sprinkler Fires.

	1938-1939		1897-1939	
	No. of Fires	Per Cent	No. of Fires	Per Cent
Water shut off	16	38.0	819	33.6
Generally defective equipment	1	2.3	215	8.8
Unsprinklered portions	0	..	192	7.8
Defective water supply or supplies	6	13.9	215	8.8
Slow operation of dry system or defective valve	1	2.3	76	3.1
Sprinkler system crippled due to freezing	0	..	70	2.8
Slow or defective operation of high test heads	0	..	27	1.1
Obstruction to distribution	4	9.3	145	6.0
Faulty building construction, concealed spaces, vertical openings, etc.	2	4.1	119	4.8
Hazard of occupancy too severe for average sprinkler equipment	5	11.6	143	6.0
Explosion crippled sprinkler system	6	13.9	122	5.0
Exposure or conflagration	0	..	91	3.7
Plugged heads and clogged piping	1	2.3	76	3.1
Miscellaneous	1	2.3	131	5.4
Total	43	100.0	2441	100.0

Fires in Which Failure Was Due to Water Shut Off Sprinklers.

Water shut off:	1938-1939 No. of Fires	1897-1939 No. of Fires
Unknown reason, neglect or carelessness	5	242
Before fire was out, or fire rekindled	5	161
Accidents or repairs	2	122
To prevent freezing	4	184
Probably incendiary	0	36
Leaky dry system	0	21
Defective gate valve	0	9
Miscellaneous	0	44
Total	16	819

SECTION II.

Table No. 1 — Effect of Sprinklers.

	1938-1939 No. of Fires	%	1897-1939 No. of Fires	%
Practically or entirely extinguished....	518	67.0	43543	70.2
Held fire in check.....	213	27.5	16198	26.1
Total Satisfactory.....	731	94.5	59741	96.3
Unsatisfactory	43	5.5	2441	3.7
Total.....	774	100.0	62182	100.0

Table No. 2 — Number of Sprinklers Operating—Cumulative.

No. of Fires, 1897-1939.

No. of Sprinklers Operating	Wet	%	Dry	%	No Data	Total	%
1	18838	39.2	2166	20.5	787	21791	35.1
2 or less.....	27799	57.8	3690	34.8	1148	32637	52.6
3 or less.....	32540	67.6	4626	43.6	1354	38520	62.0
4 or less.....	35753	74.2	5385	50.8	1525	42663	68.6
5 or less.....	37705	78.5	5891	55.6	1628	45224	72.8
6 or less.....	39244	81.5	6334	59.7	1719	47297	76.1
7 or less.....	40343	83.7	6691	63.2	1769	48803	78.7
8 or less.....	41348	85.9	6990	66.0	1835	50173	80.7
9 or less.....	42014	87.4	7238	68.3	1876	51128	82.3
10 or less.....	42604	88.6	7445	70.3	1925	51974	83.7
11 or less.....	43072	89.0	7612	71.9	1948	52632	84.6
12 or less.....	43564	90.6	7832	73.9	2000	53396	85.6
13 or less.....	43856	91.2	7986	75.4	2020	53862	86.6
14 or less.....	44190	91.6	8149	77.0	2049	54388	87.3
15 or less.....	44471	92.4	8278	78.2	2071	54820	88.2
20 or less.....	45417	94.4	8719	82.4	2153	56289	90.6
25 or less.....	45972	95.7	9031	85.3	2196	57199	92.0
30 or less.....	46347	96.2	9244	87.3	2228	57819	93.0
35 or less.....	46581	96.9	9396	88.8	2254	58231	93.6
40 or less.....	46788	97.2	9517	90.0	2278	58583	94.4
50 or less.....	47041	97.8	9697	91.6	2312	59050	95.0
75 or less.....	47385	98.4	9924	93.7	2349	59658	95.9
100 or less.....	47542	98.8	10044	95.0	2362	59948	96.5
Over 100.....	476		400		57	933	
No data	120		113		1035	1268	
Open head systems	0		33		0	33	
Total.....	48139		10590		3454	62182	

Table No. 3 — Number of Sprinklers Operating.

No. of Fires, 1938-1939.

No. of Sprinklers Operating	Wet	%	Dry	%	No Data	Total	%
1	209	42.2	50	22.6	7	266	34.4
2	100	19.9	29	13.1	2	131	17.0
3	59	11.9	18	8.2	3	80	10.3
4	24	4.8	17	7.7	3	44	5.7
5	18	3.6	11	5.0	0	29	3.8
6	13	2.6	8	3.6	1	22	2.9
7	15	3.0	11	5.0	2	28	3.6
8	4	0.8	7	3.2	2	13	1.7
9	4	0.8	5	2.3	1	10	1.3
10	3	0.6	7	3.2	0	10	1.3
11	6	1.2	2	0.9	0	8	1.0
12	2	0.4	5	2.3	0	7	0.9
13	1	0.2	2	0.9	1	4	0.5
14	4	0.8	6	2.7	0	10	1.3
15	11	2.2	1	0.4	0	12	1.6
16-20	9	1.8	10	4.5	2	21	2.7
21-25	1	0.2	5	2.3	3	9	1.1
26-30	2	0.4	2	0.9	1	5	0.6
31-35	1	0.2	1	0.4	1	3	0.4
36-40	3	0.6	2	0.9	1	6	0.8
41-50	0	0.0	8	3.6	1	9	1.1
51-75	2	0.4	5	2.3	2	9	1.1
76-100	1	0.2	2	0.9	0	3	0.4
Over 100	5	1.0	4	1.8	1	10	1.3
No data	1	0.2	3	1.3	21	25	3.2
Open head systems	0	0.0	0	0.0	0	0	0.0
Total	498	100.0	221	100.0	55	774	100.0

No. of Fires, 1897-1939.

No. of Sprinklers Operating	Wet	%	Dry	%	No Data	Total	%
1	18838	39.1	2166	20.4	787	21791	35.0
2	8961	18.6	1524	14.4	361	10846	17.4
3	4741	9.8	927	8.8	206	5874	9.4
4	3213	6.7	768	7.3	171	4152	6.7
5	1952	4.1	506	4.8	103	2561	4.1
6	1539	3.2	443	4.2	91	2073	3.3
7	1099	2.3	357	3.3	50	1506	2.4
8	1005	2.1	299	2.8	66	1370	2.2
9	666	1.4	248	2.3	41	955	1.5
10	590	1.2	207	1.9	49	846	1.4
11	468	1.0	167	1.6	23	658	1.1
12	492	1.0	220	2.1	52	764	1.2
13	292	0.6	154	1.5	20	466	0.8
14	334	0.7	163	1.5	29	526	0.8
15	281	0.6	129	1.2	22	432	0.7
16-20	946	2.0	441	4.2	82	1469	2.4
21-25	555	1.2	312	3.0	43	910	1.5
26-30	375	0.8	213	2.0	32	620	1.0
31-35	234	0.5	152	1.5	26	412	0.7
36-40	207	0.4	121	1.1	24	352	0.6
41-50	253	0.5	180	1.7	34	467	0.7
51-75	344	0.7	227	2.1	37	608	1.0
76-100	157	0.3	120	1.1	13	290	0.5
Over 100	476	1.0	400	3.8	57	933	1.5
No data	120	0.2	113	1.1	1035	1268	2.0
Open head systems	0	0.0	33	0.3	0	33	0.1
Total	48138	100.0	10590	100.0	3454	62182	100.0

Table No. 4 — Effect of Sprinklers by Class of Occupancy.

	Extinguished Fire		Held Fire in Check		Total Satisfactory		Unsatisfactory		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Abrasive Works	31	73.8	9	21.4	40	95.2	2	4.8	42
Agricultural Implements	88	62.0	48	33.8	136	95.8	6	4.2	142
Airplane Factories	9	53.0	8	47.0	17	100.0	0	0.0	17
Airports and Hangars	3	50.0	3	50.0	6	100.0	0	0.0	6
Alcohol Distilleries	2	28.6	4	57.1	6	85.7	1	14.3	7
Aluminum Works	7	50.0	5	35.7	12	85.7	2	14.3	14
Amusement Places	41	77.4	7	13.4	48	90.6	5	9.4	53
Apartment Houses	203	86.5	30	13.5	233	100.0	0	0.0	233
Artificial Leather Mfg.	46	54.8	35	41.7	81	96.5	3	3.5	84
Asbestos Works	30	56.6	20	37.7	50	94.3	3	5.7	53
Automobile Mfg.	377	66.2	168	29.5	545	95.7	25	4.3	570
Automobile Body Mfg.	169	59.5	88	30.9	257	90.4	27	9.6	284
Automobile Paint Shops	15	62.5	9	37.5	24	100.0	0	0.0	24
Auto Sales and Service	75	71.5	24	22.8	99	94.3	6	5.7	105
Bag Factories	59	60.8	31	32.0	90	62.8	7	7.2	97
Bakeries	235	77.0	63	20.3	298	97.3	8	2.7	306
Basket Factories	15	83.2	2	11.2	17	94.4	1	5.6	18
Battery Mfg.	48	65.7	22	30.2	70	95.9	3	4.1	73
Bolt, Nut, and Screw Works	27	60.0	15	33.3	42	93.3	3	6.7	45
Bottle Cap and Seals Mfg.	58	50.8	42	40.2	100	100.0	0	0.0	100
Bottling Works	15	79.0	3	15.8	18	94.8	1	5.2	19
Braid Mills	74	75.5	22	22.5	96	98.0	2	2.0	98
Brass and Copper Works	91	73.4	30	24.2	121	97.6	3	2.4	124
Breweries	7	58.3	5	41.7	12	100.0	0	0.0	12
Brick and Tile Works	1	100.0	0	0.0	1	100.0	0	0.0	1
Broom Factories	30	73.2	8	19.5	38	92.7	3	7.3	41
Brush Factories	39	70.9	15	27.3	54	98.2	1	1.8	55
Buildings Under Construction	5	50.0	3	30.0	8	80.0	2	20.0	10
Button Factories	88	83.8	15	14.3	103	98.1	2	1.9	105
Candle Factories	10	58.8	7	41.2	17	100.0	0	0.0	17
Candy Factories	286	72.5	98	24.8	384	97.3	11	2.7	395
Canneries	25	67.5	9	24.3	34	92.8	3	8.2	37
Canvas and Cotton Belting	9	69.2	4	30.8	13	100.0	0	0.0	13
Carbon Works	12	80.0	3	20.0	15	100.0	0	0.0	15
Car Houses	48	46.5	46	44.7	94	91.2	9	8.8	103
Car Works	84	61.4	49	24.8	133	93.2	4	2.7	137
Carpet and Rug Mills	239	65.4	113	30.9	352	96.3	14	3.7	366
Casket Mfg.	92	75.4	25	20.5	117	95.9	5	4.1	122
Cement and Plaster Mills	16	72.8	3	13.6	19	86.4	3	13.6	22
Cereal Mills	46	63.9	18	25.0	64	88.9	8	11.1	72
Chemical and White Lead Works	264	63.2	129	30.8	393	94.0	26	6.0	419
Churches	1	50.0	1	50.0	2	100.0	0	0.0	2
Clock and Watch Mfg.	22	81.5	5	18.5	27	100.0	0	0.0	27
Clothing Mfg.	2594	86.6	399	13.3	2993	99.9	25	0.1	3018
Clubs—City	40	85.2	6	12.7	46	97.9	1	2.1	47
Clubs—Country	29	65.9	14	31.8	43	97.7	1	2.3	44
Coal and Wood Yards	3	27.3	7	63.6	10	90.0	1	9.1	11
Cocoanut Mills	6	75.0	2	25.0	8	100.0	0	0.0	8
Coffee and Spice Plants	113	72.5	40	25.5	153	98.0	3	2.0	156
Cold Storage Plants	20	71.4	8	28.6	28	100.0	0	0.0	28
Cooperage Plants	70	72.0	33	26.0	103	98.0	14	2.0	117
Cordage Works	276	65.7	129	30.7	405	96.4	16	3.6	421
Cork Plants	44	60.3	23	31.5	67	91.8	6	8.2	73
Cotton Gins	14	60.9	7	30.4	21	91.3	2	8.7	23
Cotton Mills	7026	65.8	3531	33.0	10557	98.8	124	1.2	10681
Cotton Seed Oil Mills	49	46.3	35	33.0	84	79.3	22	20.7	106
Cotton Warehouses	288	50.0	235	41.0	523	91.0	53	9.0	576

	Extinguished Fire		Held Fire in Check		Total Satisfactory		Unsatisfactory		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Cutlery Mfg.	31	59.4	18	33.0	49	94.2	3	5.8	52
Dairies and Creameries	12	70.6	5	29.4	17	100.0	0	0.0	17
Department Stores	970	80.8	209	17.4	1179	98.2	25	1.8	1204
Distilleries	17	60.7	6	21.4	23	82.1	5	17.9	28
Doll Factories	101	66.0	52	34.0	153	100.0	0	0.0	153
Drug Mfg. and Warehouse	297	80.0	65	17.2	362	97.2	10	2.8	372
Dry Cleaning Establishments	38	65.5	18	31.0	56	96.5	2	3.5	58
Dry Goods Stores	435	85.5	62	12.3	497	98.8	6	1.2	506
Dwellings	2	66.7	0	0.0	2	66.7	1	33.3	3
Dyeing, Bleaching, Finishing	363	61.2	212	35.6	575	96.8	19	3.2	594
Electrical Appliance Mfg.	629	73.9	207	24.3	836	98.2	15	1.8	851
Electric Power and Light	10	43.5	9	39.1	19	82.6	4	17.4	23
Excelsior Factories	39	67.3	14	24.1	53	91.4	5	8.6	58
Fertilizer Plants	33	66.0	13	26.0	46	92.0	4	8.0	50
Fibre Products	24	55.8	14	32.6	38	88.4	5	11.6	43
Fireworks Plants	2	28.6	3	42.8	5	71.4	2	28.6	7
Flax and Linen Mills	54	58.7	37	40.2	91	98.9	1	1.1	92
Flour and Grist Mills	112	55.8	56	27.9	168	93.7	33	16.3	201
Forge and Smithy	31	70.5	11	25.0	42	95.5	2	4.5	44
Foundries	275	60.6	157	34.6	432	95.2	22	4.8	454
Fruit Packing	12	85.8	2	14.2	14	100.0	0	0.0	14
Fur Works	290	91.9	20	6.3	310	98.2	6	1.8	316
Furniture Factories	1221	68.6	436	24.4	1657	93.0	125	7.0	1782
Furniture Stores	173	80.1	35	16.2	208	96.3	8	3.7	216
Garages	745	72.2	266	25.7	1011	97.9	22	2.1	1033
Garbage Reduction Plants	3	50.0	2	33.3	5	83.3	1	16.7	6
Gas Works	4	44.4	4	44.5	8	88.9	1	11.1	9
General Stores	1	50.0	1	50.0	2	100.0	0	0.0	2
Glass Factories	124	61.4	59	29.2	183	90.6	19	9.4	202
Glove Factories	23	67.7	10	29.4	33	97.1	1	2.9	34
Glue Factories	11	47.9	9	39.1	20	87.0	3	13.0	23
Grain Elevators	51	44.0	37	32.0	88	76.0	28	24.0	116
Groceries	266	79.4	56	16.7	322	96.1	13	3.9	335
Gum Mfg.	11	78.6	3	21.4	14	100.0	0	0.0	14
Hair Works	33	78.6	9	21.4	42	100.0	0	0.0	42
Hardware Stores	145	81.5	30	16.8	175	98.3	3	1.7	178
Hat Factories	526	80.8	104	15.9	630	96.7	21	3.3	651
Hospitals	42	82.4	9	17.6	51	100.0	0	0.0	51
Hotels—Year Round	157	82.7	28	14.7	185	97.4	5	2.6	190
Hotels—Seasonal	26	74.3	8	22.8	34	97.1	1	2.9	35
Ice Cream Mfg.	7	58.3	5	41.7	12	100.0	0	0.0	12
Ice Houses	0	0.0	2	66.7	2	66.7	1	33.3	3
Ice Mfg.	2	66.7	1	33.3	3	100.0	0	0.0	3
Idle and Vacant Property	57	53.8	25	23.6	82	77.4	24	22.6	106
Incandescent Lamp Works	27	67.5	13	32.5	40	100.0	0	0.0	40
Institutions	23	95.8	1	4.2	24	100.0	0	0.0	24
Insulated Wire Works	76	67.3	35	31.0	111	98.3	2	1.7	113
Jewelry Factories	233	83.4	39	13.8	272	97.2	8	2.8	280
Junk Shops	41	65.1	17	27.0	58	92.1	5	7.9	63
Knitting Mills—Cop Yarn	82	70.1	28	23.9	110	94.0	7	6.0	117
Knitting Mills—Full Process	728	69.3	284	27.2	1012	96.5	34	3.5	1046
Lamp Shade Factories	62	89.8	6	8.7	68	98.5	1	1.5	69
Laundries	228	74.3	70	22.8	298	97.1	9	2.9	307
Leather Working	296	82.8	57	15.9	353	98.7	5	1.3	358
Linoleum Works	46	31.3	81	55.0	127	86.3	20	13.7	147
Linseed Oil Works	30	51.8	19	32.8	49	84.6	9	15.4	58
Lumber Yards	12	54.6	9	40.8	21	95.4	1	4.6	22
Macaroni Factories	14	60.9	7	30.4	21	91.3	2	8.7	23
Machine Shops and Works	539	72.5	170	22.8	709	95.3	35	4.7	744

	Extinguished Fire		Held Fire in Check		Total Satisfactory		Unsatisfactory		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Mail Order Houses	69	86.3	11	13.7	80	100.0	0	0.0	80
Match Factories	82	75.2	22	20.2	104	95.4	5	4.6	109
Mattress Factories	757	72.0	276	26.3	1033	98.3	18	1.7	1051
Mercantile (Miscellaneous)	1242	83.1	217	14.5	1459	97.6	36	2.4	1495
Metal Reduction Plants†	11	61.1	7	38.9	18	100.0	0	0.0	18
Metal Workers	1482	64.8	717	31.4	2199	96.2	83	3.8	2282
Mining Property	7	63.6	3	27.3	10	90.9	1	9.1	11
Mirror Mfg.	22	88.0	2	8.0	24	96.0	1	4.0	25
Miscellaneous	513	75.5	148	21.7	661	97.2	19	2.8	680
Motion Picture Exchanges	59	79.0	14	18.3	73	97.3	2	2.7	75
Motion Picture Studios	67	76.0	19	21.7	86	97.7	2	2.3	88
Motion Picture Theatres	119	78.8	26	17.2	145	96.0	6	4.0	151
Multiple Occupancy	251	78.5	52	16.2	303	94.7	17	5.3	320
Munitions	27	44.3	24	39.3	51	83.6	10	16.4	61
Musical Instrument Factories	175	71.2	64	26.0	239	97.2	7	2.8	246
Office Buildings	151	89.5	17	10.1	168	99.6	1	0.4	169
Oil Cloth Works	39	51.3	30	39.5	69	90.8	7	9.2	76
Oil Clothing Factories	26	86.7	3	10.0	29	96.7	1	3.3	30
Oil Distributing Stations	2	40.0	3	60.0	5	100.0	0	0.0	5
Oil Refineries—Animal	5	55.6	3	33.3	8	88.9	1	11.1	9
Oil Refineries—Mineral	7	58.4	4	33.3	11	91.7	1	8.3	12
Oil Refineries—Vegetable	13	48.2	12	44.4	25	92.6	2	7.4	27
Optical Works	28	68.3	13	31.7	41	100.0	0	0.0	41
Packing Houses	222	68.0	90	27.4	312	95.4	15	4.6	327
Paint and Varnish Works	359	65.4	164	30.1	523	95.5	22	4.5	545
Paper Coating Mills	51	67.1	19	25.0	70	92.1	6	7.9	76
Paper Mills	784	52.7	574	38.5	1358	91.2	131	8.8	1489
Paper Working	498	74.3	157	23.4	655	97.7	16	2.3	671
Peanut Roasting Plants	7	53.8	3	23.1	10	76.9	3	23.1	13
Pencil Factories	22	71.0	8	25.8	30	96.8	1	3.2	31
Phonograph Works	37	68.5	15	27.8	52	96.3	2	3.7	54
Photo Camera and Film Mfg.	30	73.2	11	26.8	41	100.0	0	0.0	41
Photo Engraving and Studios	73	88.0	9	10.8	82	98.8	1	1.2	83
Picture Frame Mfg.	69	68.3	26	25.8	95	94.1	6	5.9	101
Piers and Wharves	33	55.0	24	40.0	57	95.0	3	5.0	60
Plumbers Supplies	48	72.8	15	22.7	63	95.5	3	4.5	66
Potteries	62	64.6	26	27.1	88	91.7	8	8.3	96
Printing and Lithographing	1405	83.3	254	15.0	1659	98.3	29	1.7	1688
Prisons	7	50.0	5	35.7	12	85.7	2	14.3	14
Public Buildings	15	75.0	3	15.0	18	90.0	2	10.0	20
Pulp Mills	54	39.1	57	41.3	111	80.4	27	19.6	138
Pyroxylin Plastic Mfg., Fabrication	322	66.8	112	23.2	434	90.0	48	10.0	482
Radios and Accessories	80	81.6	15	15.3	95	96.9	3	3.1	98
Railroad—Misc. Property	5	29.4	11	64.7	16	94.1	1	5.9	17
Railroad—Repair Shops	4	33.3	8	66.6	12	100.0	0	0.0	12
Rayon Mills	34	81.0	6	14.2	40	95.2	2	4.8	42
Restaurants	273	76.5	79	22.1	352	98.6	5	1.4	357
Rice Mills	3	33.3	2	22.2	5	0.0	4	44.5	9
Rolling, Wire and Tube Mills	97	62.6	52	33.5	149	96.1	6	3.9	155
Roofing Works	57	38.3	81	54.3	138	92.6	11	7.4	149
Rooming and Lodging Houses	10	90.9	0	0.0	10	90.9	1	9.1	11
Rubber Cloth Factories	113	68.2	49	29.5	162	97.7	4	2.3	166
Rubber Reclaiming Works	24	53.3	11	24.5	35	77.8	10	22.2	45
Rubber Mills	341	58.2	217	36.9	558	95.1	29	4.9	587
Salt Works	2	50.0	2	50.0	4	100.0	0	0.0	4
Saw and Planing Mills	133	42.4	98	31.2	231	73.6	83	26.4	314
Schools—Colleges and Universities	23	82.1	5	17.9	28	100.0	0	0.0	28
Schools—Private	8	66.7	3	25.0	11	91.7	1	8.3	12
Schools—Public	9	52.9	5	29.4	14	82.3	3	17.7	17

	Extinguished Fire		Held Fire in Check		Total Satisfactory		Unsatisfactory		Total No. of Fires
	No.	%	No.	%	No.	%	No.	%	
Schools—Trade and Industrial	15	79.0	2	10.5	17	89.5	2	10.5	19
Shipyards	21	53.8	15	38.5	36	92.3	3	7.7	39
Shoddy Mills	304	63.8	146	30.6	450	94.4	27	5.6	477
Shoe Factories	1149	75.8	318	20.9	1467	96.7	51	3.3	1518
Shoe Mfg. Accessories	116	71.2	40	24.5	156	95.7	7	4.3	163
Shoe Stores	103	88.8	13	11.2	116	100.0	0	0.0	116
Silk Mills	219	82.4	39	14.6	258	97.0	8	3.0	266
Smelting and Refining	8	61.5	4	30.8	12	92.3	1	7.7	13
Soap Mfg.	64	71.1	23	25.6	87	96.7	3	3.3	90
Stables	25	75.8	8	24.2	33	100.0	0	0.0	33
Stamping and Sheet Metal Works	213	63.8	103	30.8	316	94.6	18	5.4	334
Starch and Glucose	17	54.8	6	19.4	23	74.2	8	25.8	31
Stone Working	4	100.0	0	0.0	4	100.0	0	0.0	4
Sugar Refineries	47	52.3	39	43.4	86	95.7	4	4.3	90
Tannery, Class A**	29	44.6	30	46.2	59	90.8	6	9.2	65
Tannery, Class B**	157	59.5	86	32.5	243	92.0	21	8.0	264
Tannery, Class C**	19	41.3	21	45.7	40	87.0	6	13.0	46
Tannery, Class D**	31	70.5	11	25.0	42	95.5	2	4.5	44
Telephone Exchanges	4	100.0	0	0.0	4	100.0	0	0.0	4
Tenant Mfg.	2282	79.4	494	17.0	2776	96.4	103	3.6	2879
Theatres	112	76.8	26	17.8	138	94.6	8	5.4	146
Tobacco Factories	101	75.4	28	20.9	129	96.3	5	3.7	134
Tobacco Warehouses	10	62.5	5	31.2	15	93.7	1	6.3	16
Trunk Factories	51	74.0	11	15.9	62	89.9	7	10.1	69
Umbrella Mfg.	23	81.6	4	14.8	27	96.4	1	3.6	28
Vinegar Works	2	100.0	0	0.0	2	100.0	0	0.0	2
Wall Paper Factories	31	72.1	8	18.6	39	90.7	4	9.3	43
Warehouses	602	74.2	168	20.7	770	94.9	42	5.1	812
Waste and Batting Mills	450	61.3	253	34.4	703	95.7	32	4.3	735
Waste Paper and Rag Shops	352	65.3	161	29.9	513	95.2	26	4.8	539
Water Works	1	33.3	2	66.7	3	100.0	0	0.0	3
Weaving Mills	230	70.4	90	27.5	320	97.9	7	2.1	327
Window Shade Factories	21	77.8	4	14.8	25	92.6	2	7.4	27
Woodworker, Class A*	232	55.0	134	31.6	366	86.6	57	13.4	423
Woodworker, Class B*	228	54.0	157	37.0	385	91.0	38	9.0	423
Woodworker, Class C*	244	62.3	126	32.1	370	95.4	22	5.6	392
Woodworker, Class D*	158	57.2	92	33.2	250	90.4	27	9.6	277
Woodworker, Class E*	224	64.4	106	30.4	330	94.8	18	5.2	348
Woodworker, Class F*	52	59.0	30	34.2	82	93.2	6	6.8	88
Woodworker, Class G*	3	20.0	10	66.7	13	86.7	2	13.3	15
Woodworker, Class H*	109	78.3	28	20.3	137	98.6	2	1.4	139
Woolen Mills	1363	70.5	488	25.2	1851	95.7	84	4.3	1935
Wool Scouring Plants	44	68.7	17	26.6	61	95.3	3	4.7	64
Wool Storehouses	35	68.6	13	25.5	48	94.1	3	5.9	51
Worsted Mills	114	61.4	57	30.5	171	91.9	15	8.1	186
Total	43543		16191		59734		2448		62182

*The Woodworkers are classified as follows:

Class A. Interior Woodwork, builders' supplies (including veneer works). Class B. Box Factories (including cigar boxes). Class C. Miscellaneous Woodworkers. Steam power tenant Woodworkers. Woodworkers where there is a lack of detailed information as to class. Class D. Sash, Door and Blind Factories. Class E. Hard Wood Turning (wheels, pipes, novelties, bobbins, spools, etc.). Class F. Pails and Woodenware (plates, wooden bowls, tubs, etc.). Class G. Wood Flour Mills. Class H. Wood Heel and Shoe Last Factories.

†Other Metal Working Occupancies are included under Agricultural Implements; Automobile and Bicycle Factories; Bolt, Nut and Screw Works; Electrical Appliances; Forge and Smithy; Foundries; Machine Works; Rolling, Wire and Tube Works; and Stamping and Sheet Metal Works.

**See detailed classification of Tanneries as given in note under Table No. 5.

Table No. 5 — Classification of Unsatisfactory Sprinkler Fires by Occupancy.

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged heads and clogged piping.	Miscellaneous.	Total.
Abrasive Works	..	1	..	..	..	..	..	..	..	..	..	..	1	2
Agricultural Implements	3	1	..	..	..	..	..	1	1	..	..	..	..	6
Alcohol Distilleries	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Aluminum Works	..	..	..	..	..	..	..	..	1	1	..	..	..	2
Amusement Places	3	..	..	..	..	..	1	..	..	..	..	1	..	5
Artificial Leather Mfg.	..	..	..	..	..	..	1	..	..	2	..	..	..	3
Asbestos Works	..	..	2	..	..	..	..	..	..	1	..	..	..	3
Automobile Mfg.	11	2	2	..	1	..	..	4	..	2	1	2	..	25
Auto Body Mfg.	4	6	3	..	2	..	2	3	1	1	3	1	1	27
Auto Sales and Service	3	1	..	1	..	..	..	..	..	1	..	..	..	6
Bag Factories	2	..	..	..	..	2	..	1	..	..	..	2	..	7
Bakeries	4	1	..	..	..	..	1	..	..	..	..	..	2	8
Basket Factories	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Battery Mfg.	2	..	..	..	..	..	..	..	..	..	..	1	..	3
Bolt, Nut, and Screw Works	1	2	..	..	..	..	..	..	..	..	..	..	..	3
Bottling Works	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Braid Mills	..	1	..	..	..	..	..	1	..	..	..	..	..	2
Brass and Copper Works	1	1	..	..	..	..	..	..	..	..	..	..	1	3
Broom Factories	3	..	..	..	..	..	..	..	..	..	..	..	..	3
Brush Factories	..	..	..	1	..	..	..	..	..	..	..	..	..	1
Building Construction	1	..	..	..	..	..	1	..	..	..	..	..	..	2
Button Factories	..	..	..	2	..	..	..	..	..	..	..	..	..	2
Candy Factories	4	..	..	1	1	..	1	..	..	..	1	2	1	11
Canneries	1	..	..	..	1	..	..	..	..	..	1	..	..	3
Car Houses	2	3	1	..	1	..	..	1	..	..	..	1	..	9
Car Works	2	..	..	..	..	..	1	1	..	..	..	..	..	4
Carpet and Rug Mills	4	3	4	1	..	..	..	2	..	..	..	..	..	14
Casket Mfg.	2	..	..	1	1	..	1	..	..	..	..	..	..	5
Cement and Plaster Mills	1	1	..	..	1	..	..	..	..	..	..	..	..	3
Cereal Mills	..	2	1	..	..	..	..	1	..	4	..	..	..	8
Chemical & White Lead Wks.	3	5	..	..	..	..	..	1	6	9	1	..	1	26
Clothing Mfg.	10	2	1	1	..	..	3	2	..	..	2	2	2	25
Clubs—City	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Clubs—Country	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Coal and Wood Yards	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Coffee and Spice Plants	2	..	..	..	..	..	..	..	..	1	..	..	..	3
Cooperage Plants	1	4	..	..	..	1	2	4	..	..	2	..	..	14
Cordage Works	5	5	1	1	..	..	..	3	..	..	..	..	1	16
Cork Plants	1	..	1	..	..	..	..	..	2	1	..	..	1	6
Cotton Gins	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Cotton Mills	43	28	11	2	2	1	5	3	4	2	..	8	15	124
Cotton Seed Oil Mills	4	7	6	..	..	..	..	..	2	..	..	1	2	22
Cotton Warehouses	18	4	9	..	2	..	1	8	4	..	..	4	3	53
Cutlery Mfg.	1	1	1	..	..	..	..	..	..	..	..	..	..	3
Department Stores	12	4	1	..	2	..	2	1	..	..	2	..	1	25
Distilleries	2	..	..	..	..	..	..	..	..	1	1	..	1	5
Drug Mfg. and Warehouses.	3	..	..	..	1	..	..	..	..	2	3	..	1	10

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged heads and clogged piping.	Miscellaneous.	Total.
Dry Cleaning Establishments	..	..	..	..	..	..	..	..	1	..	..	1	..	2
Dry Goods Stores	4	..	..	..	..	..	1	1	..	..	..	..	..	6
Dwellings	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Dyeing, Bleaching, Finishing	7	3	1	..	1	2	..	2	..	..	1	1	1	19
Electrical Appliance Mfg.	4	1	2	..	..	..	1	2	..	1	..	1	3	15
Electric Power and Light	2	1	..	..	..	..	1	..	..	..	..	..	..	4
Excelsior Factories	..	..	3	..	1	..	..	..	1	..	..	..	..	5
Fertilizer Plants	2	1	..	..	1	..	..	..	..	..	..	..	..	4
Fibre Products	1	1	1	..	..	..	..	1	..	..	..	1	..	5
Fireworks Plants	..	..	..	..	..	..	..	..	..	2	..	..	..	2
Flax and Linen Mills	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Flour and Grist Mills	10	5	2	..	1	..	1	1	2	7	2	..	2	33
Forge and Smithy	..	..	..	..	..	..	..	1	..	..	..	..	1	2
Foundries	15	..	1	..	1	..	1	1	..	2	1	..	..	22
Fur Works	2	1	..	..	..	..	2	..	..	..	..	..	1	6
Furniture Factories	43	23	10	4	2	..	4	12	15	1	4	4	3	125
Furniture Stores	6	..	..	..	1	..	1	..	..	..	..	..	..	8
Garages	14	..	..	2	1	..	..	3	..	1	..	..	1	22
Garbage Reduction Plants	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Gas Works	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Glass Factories	4	4	3	1	..	..	3	1	..	..	..	..	3	19
Glove Factories	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Glue Factories	2	..	..	..	..	..	..	..	1	..	..	..	..	3
Grain Elevators	1	5	5	..	4	..	2	1	1	6	2	..	1	28
Groceries	8	..	1	..	1	..	1	..	1	1	..	..	..	13
Hardware Stores	2	..	..	..	..	..	..	..	..	..	..	..	1	3
Hat Factories	9	4	2	..	1	..	..	2	..	..	..	..	3	21
Hotels—Year Round	2	1	1	..	..	..	1	..	..	..	..	..	..	5
Hotels—Seasonal	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Ice Houses	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Idle and Vacant Property	16	1	..	3	..	..	1	1	..	..	1	1	..	24
Insulated Wire Works	..	2	..	..	..	..	..	..	..	..	..	..	..	2
Jewelry Factories	4	1	..	2	..	..	1	..	..	..	..	..	..	8
Junk Shops	3	..	..	..	1	..	..	..	..	..	1	..	..	5
Knitting Mills—Cop Yarn	1	1	3	..	..	..	..	1	..	1	..	..	..	7
Knitting Mills—Full Process	13	10	6	1	1	..	1	..	..	1	..	1	..	34
Lamp Shade Factories	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Laundries	7	..	1	..	..	..	..	1	..	..	..	..	..	9
Leather Working	1	..	1	..	1	..	..	1	..	..	..	..	1	5
Linoleum Works	..	8	1	..	..	..	2	2	7	..	..	..	..	20
Linseed Oil Works	2	1	..	..	..	..	1	..	1	2	..	2	..	9
Lumber Yards	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Macaroni Factories	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Machine Shops and Works	21	6	1	1	..	1	..	..	1	2	..	2	..	35
Match Factories	2	..	..	..	..	..	..	..	2	..	..	..	1	5
Mattress Factories	13	2	..	1	..	..	..	2	..	..	..	..	..	18
Mercantile (Miscellaneous)	16	6	1	2	..	..	5	..	..	..	4	..	2	36
Metal Workers†	28	18	4	1	2	2	5	4	6	5	2	3	3	83

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged heads and clogged piping.	Miscellaneous.	Total.
Mining Property	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Mirror Mfg.	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Miscellaneous	5	2	1	..	2	..	2	..	5	..	..	..	2	19
Motion Picture Exchanges	..	..	..	..	1	..	..	..	1	..	..	..	..	2
Motion Picture Studios	..	..	..	..	..	..	..	..	1	1	..	..	..	2
Motion Picture Theatres	2	1	..	..	..	..	..	1	..	1	1	..	..	6
Multiple Occupancy	4	1	1	1	1	..	6	..	..	2	..	..	1	17
Munition Plants	2	..	..	1	..	..	..	..	4	2	..	..	1	10
Musical Instrument Mfg.	1	4	..	..	..	..	1	..	..	..	1	..	..	7
Office Buildings	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Oil Cloth Works	..	..	..	..	..	..	..	1	6	..	..	..	..	7
Oil Clothing Factories	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Oil Refining—Animal	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Oil Refining—Mineral	..	..	..	..	..	1	..	..	..	..	..	..	..	1
Oil Refining—Vegetable	1	..	1	..	..	..	..	..	..	..	..	..	..	2
Packing Houses	7	2	1	..	2	..	..	..	1	1	..	..	1	15
Paint and Varnish Works	5	3	6	..	1	..	3	1	..	3	..	..	..	22
Paper Coating Mills	2	..	..	..	..	..	..	2	..	1	..	..	1	6
Paper Mills	34	26	19	5	2	3	3	10	4	3	3	8	11	131
Paper Working	7	1	2	..	1	..	..	3	1	..	..	1	..	16
Peanut Roasting Plants	..	..	1	..	..	..	..	..	..	..	2	..	..	3
Pencil Factories	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Phonograph Works	2	..	..	..	..	..	..	..	..	..	..	..	..	2
Photo Engraving & Studios	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Picture Frame Mfg.	1	2	1	1	..	..	..	1	..	..	..	..	..	6
Piers and Wharves	..	2	1	..	..	..	..	..	..	..	..	..	..	3
Plumbers Supplies	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Potteries	3	2	1	1	..	..	..	..	..	1	..	..	..	8
Printing and Lithographing	12	5	1	..	1	..	3	2	1	..	3	..	1	29
Prisons	..	..	..	..	1	..	..	..	1	..	..	..	..	2
Public Buildings	..	..	..	..	1	..	..	..	..	..	..	1	..	2
Pulp Mills	12	4	4	..	1	1	1	..	1	1	..	..	2	27
Pyroxylin Plastic Mfg. and Fabricating	4	1	4	1	1	..	2	3	23	7	2	..	..	48
Radios and Accessories	2	..	..	..	..	..	..	..	..	..	..	1	..	3
Railroad Miscellaneous	..	..	..	..	..	..	..	..	..	..	..	1	..	1
Rayon Mills	..	1	..	..	..	..	..	..	..	..	..	..	1	2
Restaurant	1	1	..	..	..	..	1	2	..	..	..	..	..	5
Rice Mills	..	1	1	..	..	..	..	..	..	..	..	..	2	4
Rolling Wire and Tube Mills	..	1	..	..	1	1	1	..	..	..	1	1	..	6
Roofing Works	3	2	1	1	..	..	1	2	..	1	..	..	..	11
Rooming & Lodging Houses	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Rubber Cloth Factories	2	1	..	..	..	..	..	..	..	..	..	..	1	4
Rubber Reclaiming Works	3	..	1	..	..	..	1	1	2	1	1	..	..	10
Rubber Mills	9	1	..	1	..	..	..	1	7	8	..	1	1	29
Saw and Planing Mills	22	15	7	1	7	1	6	4	9	..	5	1	5	83
Schools—Private	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Schools—Public	1	1	..	..	..	..	1	..	..	..	..	..	..	3
Schools—Trade & Industrial	1	..	1	..	..	..	..	..	..	..	..	..	..	2

	Water shut off sprinklers.	Generally defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed spaces, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Sprinkler system crippled by explosion.	Exposure or conflagration.	Plugged heads and clogged piping.	Miscellaneous.	Total.
Shipyards	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Shoddy Mills	6	4	8	1	1	3	1	2	..	..	..	..	1	27
Shoe Factories	20	8	3	..	1	1	2	3	..	3	6	1	3	51
Shoe Mfg. Accessories	3	2	..	1	..	..	..	..	..	..	..	..	1	7
Silk Mills	3	2	..	..	..	..	..	..	..	1	..	..	2	8
Smelting and Refining	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Soap Manufacturing	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Stamping & Sheet Metal Wks.	4	5	1	..	1	..	2	1	..	1	2	..	1	18
Starch and Glucose Works	..	..	..	..	..	..	..	..	1	7	..	..	..	8
Sugar Refineries	2	1	..	..	..	..	..	..	..	1	..	..	..	4
Tannery, Class A**	1	2	..	1	..	..	..	..	..	..	1	..	1	6
Tannery, Class B**	9	4	..	2	3	..	1	1	..	..	..	..	1	21
Tannery, Class C**	2	..	1	1	..	..	1	..	..	..	1	..	..	6
Tannery, Class D**	..	..	..	2	..	..	..	..	..	..	..	..	..	2
Tenant Mfg.	61	11	2	5	1	..	4	4	2	1	7	2	3	103
Theatres	5	3	..	..	..	..	..	..	..	..	..	..	..	8
Tobacco Factories	1	1	..	..	..	..	1	..	1	..	1	..	..	5
Tobacco Warehouses	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Trunk Factories	3	1	1	..	..	..	1	..	..	..	1	..	..	7
Umbrella Mfg.	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Wall Paper Factories	..	..	1	..	..	..	..	1	1	..	1	..	..	4
Warehouses	16	4	5	..	2	..	3	3	3	1	..	2	3	42
Waste and Batting Mills	10	4	5	2	2	1	..	2	3	..	..	3	1	33
Waste Paper and Rag Sorting	13	4	1	3	..	..	..	1	..	..	..	..	2	24
Weaving Mills	1	1	2	1	..	..	..	2	..	..	..	..	..	7
Window Shade Factories	..	..	..	1	..	..	..	..	1	..	..	..	..	2
Woodworker, Class A*	14	12	5	1	2	1	2	6	1	3	4	2	4	57
Woodworker, Class B*	10	9	3	3	1	2	1	1	..	3	2	3	..	38
Woodworker, Class C*	7	6	3	..	..	..	1	3	..	1	..	..	1	22
Woodworker, Class D*	3	12	..	1	2	..	..	..	1	2	4	..	3	28
Woodworker, Class E*	7	1	1	..	2	1	2	..	1	..	1	1	1	18
Woodworker, Class F*	2	1	1	..	..	..	..	2	..	..	..	..	..	6
Woodworker, Class G*	..	..	..	..	..	..	..	..	..	2	..	..	..	2
Woodworker, Class H*	..	1	..	..	..	..	..	..	..	..	..	1	..	2
Woolen Mills	23	21	17	2	..	2	4	1	1	..	3	4	6	84
Wool Scouring	..	1	1	..	..	..	1	..	..	..	..	..	..	3
Wool Storehouse	1	2	..	..	..	..	..	..	..	..	..	..	..	3
Worsted Mills	3	4	2	1	..	..	1	..	..	..	..	..	4	15
Total	819	407	215	70	76	27	119	145	143	122	91	76	131	2441

†See note on Metal Workers under Table No. 4.

*See detailed classification of Woodworkers as given in note under Table 4.

**The Tanneries are classified as follows:

Class A. Sole Leather and Belting.

Class B. Upper Leather (Calfskins, Sheepskins, Morocco).

Class C. Patent Leather.

Class D. Skin Mills (Glove Leather).

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